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UNLIMITED LIABILITY.

One of the cardinal principles of Co-operative Credit, at least as regards the small village Society, is unlimited liability. Unless each member realises that the whole of his goods are pledged, not only for his own liabilities but for all the liabilities of the Society, it is difficult to secure his personal interest in the Society to the extent which real co-operation calls for. Individually, the smaller members have no credit, and it is only by combining and agreeing to joint liability that they are able to obtain money on easy terms. The actual value of the small man's possessions may not amount to much, but the idea that he may lose them all is just as formidable to him as to his richer neighbour.

Unlimited liability provides the incentive for each to undertake the primary duty of a member of a Co-operative Credit Society, i.e., that of watching his fellow-members Such a Society does not pay inspectors or subscribe to a local "Stubbs' Gazette" in order to ascertain the comparative solvency of its members. That work must be done by the members themselves. Each member must make it his business to know whether the loans given are applied to the purpose for which they were granted, whether they are repaid at the proper time, or any other details which would affect the welfare of the Society. The position was described in plain words by a member of the first rural co-operative credit society in Italy, "we are a hundred persons, who watch one another like spies; it is not possible that any one of us should fail in his duty."

In Ceylon, objections to the assumption of unlimited liability usually come from those wealthier and philanthropic persons who have become members of a society in order to provide it with

the initial capital. They are quite prepared to risk a few hundred rupees for the benefit of their poorer neighbours, but they do not wish to be involved to an unlimited and unknown extent. This objection is quite natural, though further consideration will show that there are possible ways of meeting it.

It must be remembered that so long as the Society's funds are raised only by subscriptions from the members, no liability attaches to any member except as regards the money already subscribed. The Society is dealing with its own money and does not incur further liability. Even when the Society receives deposits, the position is exactly the same, if deposits are taken only from members. The unlimited liability only comes into play when money is borrowed by the Society from outside sources.

There are several ways in which the wealthier member can protect his interests and make the unlimited liability harmless to himself. He may secure, by Resolution at a General Meeting, a limit to the use to which the unlimited liability is to be put, or to the amount of loan to be given to any person, or to the collective amount of business. Again, the support of such a member is presumably desired, and he will be able to enforce his wishes by threatening his withdrawal from the Society if he does not approve of its transactions. This of course assumes that he takes an active part in the management and is thoroughly conversant with all its business. Indeed, if he does not take such an interest, it is questionable whether his membership is desirable. One of the sacrifices demanded of the wealthy sympathiser is that he should assist in educating the villager in the principles and aims of co-operative credit. Unless the villager realises that ultimately he must manage his own Society and be independent of philanthropic membership, co-operative credit will be non-existent.

One is tempted to suggest that the wealthier sympathisers with the movement should form independent Central Societies, with the object of lending money at a low rate of interest to the small village Societies. The disadvantages of such a procedure in the present state of Co-operative Credit in Ceylon are twofold. The villager would be deprived of the direct assistance of the only people who can teach him what co-operation really means, and in the absence of that teaching he would inevitably look upon the Central Society merely as a charity organisation and a perennial source of doles.

T. P.

CEYLON PAVILION.

RUBBER EXHIBITION—LONDON—1914

RUBBER.

NEW USES FOR INDIA RUBBER.

India rubber is the Jacob, the supplanter, of the industrial world. Rubber hose dispossessed hose of leather, the rubber-covered golf ball drove out the "gutty," the motor banished the horse. No industry or profession but has shown rubber supplanting some time-honoured object. Take, for example, the case of King David as chronicled in the first book of Kings. "David was old and stricken in years and they covered him with clothes, but he gat no heat." Then his servants got a young maid who lay in his bosom to warm him. This system presumably prevailed among elderly kings until 1850 or thereabouts, when india rubber in the form of the hot water bottle supplanted the feminine heat supplier, and has done so to a degree, ever since.

Industrially it has insinuated itself everywhere, displacing wood, metals, fabrics and only rarely making a new and original use for its wonderfully adaptable self. It was its costliness only that kept it from further encroachment.

With rubber at a shilling or twenty-five cents a pound (and that is where it is said to be going), the great expansion in its manufacture will be in the line of further and greater encroachment.

Let's afield with fancy and picture its progress:

The growth that will come in automobile and motor truck tyres has already been forecasted, but the impetus to be given to other established lines does not seem to be appreciated. All will grow greatly. The only obstacles are the increasing cost of labour—which is the most serious—and high prices for fabrics, solvents and ingredients.

INDIA RUBBER LEATHER.

In footwear of leather, rubber has already made itself a factor.

Aside from the cements used in channeling and filling, the rubber heel and sole have displaced quite a percentage of those made of leather. With low-priced, high-grade rubber, leather in soles for footwear, material for trunks, straps and a score of other uses, including machine belting and harnesses, is sure to give way to its more adaptable rival. As for shoe uppers, leather is used theoretically because of its porosity that allows heated air to escape and absorbs perspiration—this in spite of the fact that the leather is filled with oil and blacked and varnished. It is quite possible that a mixture of fibre and rubber will appear that will be cool, odorless and blackable.

As for patent leather, it is sure to be supplanted by a smooth, glossy-surfaced rubber product on a cloth backing that will not crack and will be far cheaper than the high-priced leather products. This will open a field in footwear, shopping bags, ladies' belts, etc., etc.

Indeed, wherever leather is used to-day rubber will soon prove a formidable rival.

INDIA RUBBER LUMBER.

Mats, matting and tiling of india rubber are already extensive factors in home, office and factory furnishing. But why not flooring of hard or semi-hard rubber? As has been proved in tests of tiling wear, it will outlast stone or wood. It can be made in any colour. Certainly at the present price of hardwood flooring, with rubber at 25 cents a pound, it could compete. Nor would it need varnishing, waxing or oiling—simply polishing. It could easily be moulded with a semi-hard lower side for nailing and be matched and furnished in strips of any length or width. It would be practically fire-proof, and not inflammable as is varnish-covered wood, and would neither swell nor shrink, as it would be moisture proof and vermin proof. For a white-ant country it would be invaluable. In cabinet work, hard rubber veneers to imitate ebony, mahogany, bog oak or any of the darker woods are easily made and the richest effects secured. For furniture solid mahogany sideboards, tables and chairs may be superseded by those made of hard rubber.

In other words, hard rubber lumber is in sight—the lumber sawed, planed and turned as lumber is to-day and the sawdust not a waste product but moulded into new lumber, and the furniture or panels or flooring after use returned to the mill that made them, and these, too, made into just as good hard rubber lumber as when first manufactured.

Better than rubber roofing will be the fibre and rubber shingles of the future. If the underwriters are fussy the fibre may be asbestos or the compounding ingredient infusorial earth.

Boat builders (wooden boats) have trouble with their lumber. When hard rubber lumber is available they will rejoice. It will be hard on those who copper sheath, or sell Anti-Teredo paints; for the busy water borer will not touch rubber.

Speaking of hard rubber lumber, who can say that a factory for turning it out will not one day be established in Singapore, to make boxes in which to ship rubber? The boxes of course to be sawed up into short vulcanite sheets for insulation work, once their duty as rubber carriers is finished. At least it would not be difficult to make wooden boxes with a thin coating of hard rubber vulcanized to the wood, forming a clean anti-sliver coating. Such boxes could easily be ventilated and should find use when empty.

Great European ports send to South America for Greenheart logs to build their docks, and a costly product it is. Iron columns covered with a thin film of hard rubber should be cheaper and far more durable. So, too, the protection of iron and steel in scores of places where they perish from oxidation would prove a simple, effective solution of this evil.

SEMI-HARD PIPE.

As liquid conductors there is a possibility that semi-hard rubber piping may compete with copper and lead pipes. So, too, lead armored cables may give way to those coated with semi-hard rubber. The product would be just as flexible, much lighter, and cheaper.

INDIA RUBBER WOODENWARE.

In the line of sports will come hard rubber golf clubs, cricket and base-ball bats, fishing rods, polo mallets and balls, and so on. The city policemen will no longer use a club of locust wood; it will be of hard rubber. And this will extend all through the line of woodenware where anything especially tough, flawless and fine is required.

PART OF CEYLON STAND.
RUBBER EXHIBITION—LONDON—1914.
EXHIBITS OF BLANKET CREPE.

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RUBBER LINOLEUM AND OIL CLOTH.

Speaking again of floor coverings, oil cloth and linoleum as such cannot exist once rubber is really cheap and plentiful. Every rubber manufacturer knows that a pound of Para rubber will go as far in compounding as ten pounds of boiled or oxidized oil. The oil costs, say, seven cents a pound, and rubber at less than four times that price will certainly dispossess it. Then, too, it is more flexible, easier to work and far more durable.

Artificial leathers are likely to find it difficult to compete with the rubber product that will come in with low-priced rubber. Indeed, all of the rubber counterfeits made of cellulose, celluloid or casein, whether soft or hard, are likely to find that the original will be preferred just as soon as it is the cheapest.

RUBBER SOUND DESTROYERS.

India rubber as a deterrent to noise has gone far. It will go farther. The rubber-shod taxi-cab has stilled the echoing klipperty-klip of the flat-footed cab horse. It should be used to silence the clash and clatter of the modern city electric car and the jar and clamour of elevated and subway trains. In a score of industries it is needed—as cushions under modern printing presses, laundry machines and other city nuisances.

Would it not be possible also to still the shrill clatter of the thousands of shuttles in great weaving plants by the use of rubber?

The boiler maker certainly needs some sort of rubber silencer for his work, and the pneumatic riveter will not be perfect until rubber cushions absorb the far reaching sound of its blows.

When this is accomplished and the day of deliverance comes, every bell in Christendom should send out its peal of praise—with soft rubber tongues.

RUBBER GLUE AND MUCILAGE.

Into the broad field of glues, mucilages and other adhesives will a great variety of new rubber cements force their way. The only deterrent will be high cost of solvent. But with low-priced *Hevea* rubber and the consequent fall in the price of rubber scrap, that will be melted or distilled, and new stickers and valuable by-products will be obtained that will find wide markets. Certainly a rubber glue that would be self-vulcanizing and that would not soften and let go in damp weather would be a boon.

INDIA RUBBER ROADS.

Roadways of rubber are ideal, theoretically, but the asphalts under modern manipulation are likely to be always cheaper and just as effective. Rubber sidewalks (once a non-slipper compound is evolved) made of scrap are likely one day to run for miles in the modern city.

INDIA RUBBER PAINTS.

These have in the past been widely advertised and sold, but they were oil or asphaltum at heart, not rubber. Scrap rubber is likely to furnish actual rubber paints and real rubber roofing. It will mean experiment and adjustment and a new series of dryers, but that should not baffle the chemist in this day of rubber expansion.

RUBBER CAR SPRINGS.

As the price of rubber in the past increased certain products disappeared —the rubber car spring for example. As an assistant for the excellent steel springs of to-day, with a new and lower scale of prices it will come back, not

only in railway carriages, but in manifold places where cost has prevented its use. Wherever there is a shock there will be put a rubber spring; wherever a rattle, an anti-rattler.

INDIA RUBBER PAPER.

Goodyear had a book with pages of rubber and fibre. Then rubber became costly and it was forgotten. For certain moisture proof papers rubber is certainly better than oil. In wall papers of the Lincrusta Walton type it is more than a possibility. Bible papers made of pure gum would be wonderfully suited to certain modern creeds.

RUBBER CROCKERY.

It is with much doubt that I make this suggestion—that of white rubber dishes for the great restaurants, or bath tubs of hard rubber for the home. Perhaps it is as well not to encroach upon the pottery industry until rubber becomes as cheap as Kaolin.

The list grows long, and this is but a beginning; there are scores of industries yet to be viewed, and above all the back bone of all prosperity—the farmer—has been neglected. Perhaps—and this is but a vague suggestion—if he raised his milk-fed chickens on rubber latex, egg shells would cease to be fragile.—INDIA RUBBER WORLD.

ANIMAL PESTS OF HEVEA.

MR. E. ERNEST GREEN, late Government Entomologist of Ceylon, read the following paper on "Some Animal Pests of the Hevea Rubber Tree" at the International Congress of Tropical Agriculture. He said he could only speak of those pests which occur in Ceylon plantations. Trees newly introduced into a country are generally free from insect pests unless those pests are brought with the trees. In the case of the Hevea the copious flow of latex if the bark is wounded, protects the tree to some extent from insects. But this comparative immunity does not extend to the foliage; and in the case of larger animals the latex appears to be the object sought for. It might be thought that a substance which when coagulated becomes rubber, could not be drunk by any animal with impunity, but it appears that the latex has no injurious effects either upon the lower animals or upon man himself.

Elephants, goats, pigs, porcupines, rats are among the animals which MR. GREEN mentioned as attacking the rubber tree. The porcupine, he said, revels in its sappy bark. A single animal may completely strip the stem of a three or four year old tree from the ground level up to the height of two feet. If the stripping is all around the tree, of course the tree will die; if only a small area on one side is attacked, the tree may struggle on, but it is best to remove it out of the way. The porcupine is one of the wiliest of animals and most difficult to destroy. He will not enter even the most cunningly laid of traps, and he has a keen scent for poisoned bait. The native villager uses a spring gun and has more success than any one else. The planter may watch night after night waiting his chance to shoot the porcupine, without the animal ever putting in an appearance; and then a native may set a spring gun and succeed in killing it.

The bandicoot, a huge rat with powerful saw-like teeth, is a pest that will cut through a tree several inches in circumference. Certain species of slugs were first brought to MR. GREEN's notice in 1905, as imbibing the latex from recently tapped Hevea trees. He said that quite conceivably many pounds of rubber are lost in this manner. In Java, and Sumatra also, species of slugs have been found drinking the latex. The best way of dealing with those of Ceylon is to surround the tree with a protective barrier of some strong smelling substance, e.g., sawdust saturated with crude carbolic acid may be laid around the base of the tree.

Naturally every insect that lights on a rubber tree is looked upon by the planter with suspicion, and small as is the list of pests it would be smaller still if all the merely casual visitors that are included in it were eliminated. Most of the enemies of Hevea are secondary pests that do not attack healthy trees, but the fact of their being secondary pests does not decrease their importance. They may complete the destruction of a diseased tree, when otherwise it would recover.

Certain species of grasshoppers attack the tree. White ants call for some attention, but they are not very serious in Ceylon. Nor is the notorious *Termes gestroi* a pest there. Certain large beetles lay their eggs on the ground near the trees, and the newly hatched larvæ burrow down and attack the roots. The best protector from these is nitrate of soda. A species of longicorn, not a native of Ceylon and only recently introduced, has become a serious pest.

Boring beetles have attracted more attention than any other pest. They are found in the stems of dead trees, but it does not follow that they have killed them. In fact, it is doubtful if these small beetles can penetrate the bark of a healthy rubber tree, although the fact that latex is sometimes found to be exuding and flowing down the stem is taken by some planters as proof that these insects will attack healthy trees. But there are other causes of bleeding. For example, dead bark may separate from the wood, leaving a cavity surrounded by healthy tissue. If the dead bark forms a cortex over this cavity and is pierced by the borers the latex will flow down the tree.

With such a large area under cultivation it may seem astonishing that the list of pests is so small, and the increased attention being given to the matter makes it more difficult for them to obtain a foothold. But large, unbroken areas of a single cultivation always give conditions favourable for the establishment of a pest; and it is sound policy to break up such an area by interplanting with other trees. By this means any disease-stricken area may be confined within practicable limits.

In discussion, MR. WHITBY said he much inclined to agree with MR. GREEN that one of the functions of the latex is to act as a protective agent against the attacks of insects. In this connection he would draw attention to a fact which is not generally appreciated, viz., that the latex obtained from the tree after wound response has set in is of a different quality from that which flows on first tapping the tree. The latter coagulates almost immediately, but after wound response has set in the latex may remain liquid for some hours. Protection of the tree is not the prime function of the latex, but it is one of its functions. He had heard of an

interesting instance of this some time ago. The manager of the Tandjong Estate, which is largely under tobacco, found that tobacco pests swarm over the rubber trees, but as soon as they pierce the bark the latex exudes and coagulates, and consequently the pests have no influence. The fact that latex can be drunk without injury seemed to suggest to MR. WHITBY that caoutchouc is not present in it as such, but there is some other substance out of which the caoutchouc is formed.—INDIA RUBBER JOURNAL.

THE BIG RUBBER TREE, SINGAPORE.

With the first number of the second volume of the "AGRICULTURAL BULLETIN OF THE STRAITS AND THE FEDERATED MALAY STATES," 1903, a plate was published showing on the right, most of the oldest rubber trees of the Botanic Gardens, Singapore. Those which can be seen, counting from the extreme right, are numbers 1, 2, 3, 4, 5, 7, and 9 of the Gardens' trees: No. 6 and 8 stand a little back, and are not recognisable in the plate. The dimensions of the boles of these trees in the end of 1902, are given on page 1.

Death has spread down the line from No. 5, which was blown over and died in 1905. Between 1905 and 1909 No. 4 died. In 1910 No. 3 died. And now the largest of all, No. 2 is dead. *Fomes semitostus* seems to have been the cause of the trouble; but none of its fructifications have appeared.

The trees were received as seedlings in Singapore in the year 1877, and were planted out in their present place soon after their arrival. They began to seed in 1881.* It seems (Bulletin, ix, 1910, page 213) that some of the trees were tapped as early as 1889. It is recorded (Bulletin, ii, 1903, page 112) that between 1893 and 1902, they were very heavily tapped on various occasions; but it is probable that we should not now call the tapping which they had heavy. Tree No. 2 was tapped again as follows:—

18 times between March 26th and May 2nd, and May 20th and June 6th, 1903.

17 times between January 23rd and February 28th, 1905, by herring bones as a member of a group of trees called "Experiment VII."

73 times between January 22nd and June 1st, 1906, by spirals, yielding 14 lb. 7½ oz. of dry rubber and 1 lb. 8 oz. of scrap.

24 times between November 2nd and November 28th, 1906, by spirals; but the weight of the rubber is not recorded.

26 times between January 7th and February 6th, 1909, by spirals, yielding more or less 8 lb. 7 oz. of dry rubber.

54 times between September 6th and October 4th, and, between November 11th and December 6th, 1909, by spirals, yielding 14 lb. 3½ oz. of dry rubber.

37 times between January 2nd and February 12th, 1913, by spirals, yielding 11 lb. of dry rubber.

29 times between December 18th, 1913, and January 30th, 1914, by spirals, yielding 7 lb. of dry rubber in sheets, 1 lb. of clot and 2 lb. of scrap.

* This statement is not supported by contemporary record—ED.

The tree, however, has never been tested as a rubber yielder, being wanted for seed-producing, and always since 1903 tapped lightly.

Its latex seemed to clot more readily in later years than in the earlier.

It is extremely probable that it was tapped between 1906 and 1909, but records have not been found.

A plate in the AGRICULTURAL BULLETIN, Vol. vii., 1908, issued with the July number, shows the first spiral tapping of the tree and the old herring bone scars. Another illustration of it from a photograph taken a little later by MR. H. OVERBACK, occurs in MR. E. MATHIEU'S "PARA RUBBER CULTIVATION," 1909, page 125.

Successive measurements of the bole of the tree at three feet from the ground have been recorded as follows :—

1904,	6th May ...	9 feet $1\frac{1}{2}$ inches
1905,	8th May ...	9 ,, $3\frac{3}{4}$,,
1906,	8th May ...	9 ,, $5\frac{3}{4}$,,
1909,	5th May ...	10 ,, $\frac{1}{2}$,,
1910,	presumably in May ...	10 ,, $1\frac{1}{2}$,,
1911,	4th July ...	10 ,, 3 ,,
1913,	7th May ...	10 ,, $5\frac{1}{4}$,,
1914,	8th May at removal after death ...	10 ,, 5 ,,

These figures indicate that its increase of growth during the last five years has been at the rate of one inch in circumference per annum, and that for the five preceding years it was at the rate of about two inches per annum.

When uprooted it was found to be 105 feet in height, which is not unusual ; but as regards its girth we must count it an abnormality.—I. H. B. in THE GARDENS' BULLETIN, Straits Settlements.

WILD AND PLANTATION RUBBERS.

MR. A. IRVING read a paper entitled "A Comparison between Wild and Plantation Rubber." At the opening of his paper he explained the different conditions under which the trees in the Amazon district and the trees on the Eastern plantations grew, and he pointed out that the trees in the Amazon had to be at least 30 years old before they could be profitably tapped, whereas in the East trees were large enough to be tapped at four years of age. This was accounted for by the difference in the rate of growth, which in the forest was exceedingly slow. Methods of tapping were next dealt with, and he explained that in the Amazon district a small iron axe was used for this purpose, there being a superstition against the use of steel ; a collector would set off in the morning armed with his axe and as many tin cups as he would require for his day's work. He would proceed to his estrada, which was a pathway cut through the jungle, and having arrived at his first rubber tree would strike a blow into the bark about ten feet from the ground, sloping upwards at an angle of about 45 degrees. Before withdrawing the axe he would give a little twist of the wrist in order to open the wound. He would fix one of his tin cups immediately beneath the wound, either by means of a piece of clay or by sticking the edge of the

cup into the bark of the tree. He would repeat this operation about eight times away from the first cut, and continue it until the tree was completely surrounded with cuts, placing a small tin under each cut. The tapping operations would be continued on the next day immediately below the cuts that had previously been made, and this would go on until the base of the tree was reached. When the whole of the bark available had been tapped in this manner, the operation was commenced again, the bark having had time to recover from the wounds which had been inflicted. The lack of method and care employed in tapping the wild rubber trees led to a great deal of damage which was unnecessary. Properly conducted, this tapping method gave good results, and had many points in its favour, not the least being the rapidity with which the operation could be carried out. Scrap rubber was not removed from the trees, as it helped to preserve them better, preventing borers and other insects from getting into the tree. He had often been asked what reserves of rubber trees there were in the Amazon basin. There were many millions of unworked trees in the country, but their inaccessibility rendered them an unrealisable asset with rubber at its present price.

A brief description of tapping methods as carried out on Eastern plantations was then given, and MR. IRVING next turned his attention to the preparation of the raw rubber. The work of preparation of the rubber in the Amazon country was left to the individual collector, whereas in the East it was centralised in the factories on the estates. In the Amazon the latex was coagulated with smoke fumes, whereas in the East acid was used, and smoke was only added as a preservative after the rubber had been moulded into sheet or crepe form. The collector in the Amazon would erect a small hut of leaves and make a hole of about 18 inches diameter in the ground. In this he would light a fire and insert into the fire a small earthenware or iron funnel. On a paddle he would place the contents of one of the tin cups, and rotate this in the smoke. A certain amount of skill was necessary, as the density and temperature of the smoke had to be regulated ; it must be hot enough to immediately coagulate the latex, but not sufficiently hot to scorch the rubber. The scrap rubber was generally placed first on the paddle to commence the ball, and each ball might contain three grades of rubber, namely, scrap, entrefine, and hard cure. Sometimes the scrap rubber was marketed just as it was picked up beneath the trees, and it often reached the buyer in a state of putrefaction. The great advantage that fine hard Para enjoyed over plantation rubber was standardization, and until plantation rubber was standardized the manufacturers would continue to deal chiefly with that rubber which they best knew.

The question of labour was next dealt with, and MR. IRVING pointed out that the collectors were never paid in cash, but a truck system was employed. The owner of an estate supplied his labourers with food in return for their labour, and as the labourer was paid by results he became practically a partner in the business. He had also to keep his estrada clear and his house in good order, and this work had to be done gratis. The amount of rubber produced per day depended upon the ability of the worker and the condition of the estrada. He had known of cases where as much as 20 kilos had been collected in one day, but he thought the average amount was about 2 kilos, and this was subject to a 10 per cent. loss in

weight in transport. This did not include scrap rubber, which was collected in small quantities, and was negligible. With rubber at 3*s.* per lb. in London a man who collected 2 kilos per day would receive 4*s.* 4*d.* on the basis of a 50 per cent. division between him and his employer. Then, however, as he had to pay double value for the food and goods that he received, his earnings generally amounted to about 2*s.* per day. As the man usually had a wife and family dependent upon him, they would easily understand that his lot was not a particularly happy one. The estate owner generally lived on his estate, and he was financed by aviadores in Manaos or Para, and he frequently became indebted to the aviadores to such an extent as to be the owner of his estate practically in name only. He had been asked at what price would it become impossible for rubber to be produced in Brazil. That it could be produced with rubber at 3*s.* per lb. was a known fact, and since rubber production was the sole means of livelihood in the North of Brazil, he could assure them that the industry would die hard if at all. Over-tapping the trees, especially during the boom year, when there was a desire to get as much rubber as possible while it was selling at a high price, and since when the desire had been to produce as much rubber as possible to make both ends meet, killed off many of the trees, but still there were plenty left, and as long as these remained they would be tapped. Economy was a lesson still to be learned in Brazil, the industry was subject to the enormous export duty at 21½ per cent. ad valorem, and in addition there were very heavy import duties. Since practically all food supplies had to be imported this had an important bearing on the cost of the production of the rubber, having regard to the fact that the labourers were not paid in cash. So far as the export duty was concerned, there was bound to be a further reduction in this as soon as the industry showed signs of waning. It would take an extremely long time of the most acute depression to place Brazil *hors de combat* among rubber producing countries. Economies could also be effected on the estates. He did not think Brazil could learn much from the methods prevailing in the East, nor on the other hand could the Eastern plantations learn anything from Brazilian methods. In conclusion, he expressed the opinion that in the East they had never yet had the best species of Hevea tree, which was known in Brazil as black Hevea ; this black Hevea was the best milking tree he had ever seen. If they had had it in the East they would have so flooded the world with rubber that it would have been of no value at all. He did not say that the difference in quality between plantation rubber and Brazilian rubber was due to their not having the best tree. When he said that they had not the best tree, he meant so far as quantity of yield was concerned, and not quality of latex.

In reply to questions, Mr. Irving stated that the trees were never tapped above 10 feet from the ground ; in fact, it was forbidden by law in many parts of Brazil. The slow growth of the trees made the bark very hard, and in some experiments with Eastern tapping knives he found that practically no results could be obtained, and they broke the knives by the hundred.—India Rubber Journal.

FUNTUMIA IN THE BELGIAN CONGO.

At the last International Rubber Conference Mr. Edmund Laplae said they had been planting a great number of Funtumia trees in the Belgian Congo, no less than 3,000,000 trees having been planted, but only one half of

that number would ever give good yields, owing to their ignorance of the special requirements of the trees. The Funtumia trees were quite different from Hevea. When planted in the open or at a distance of about 20 feet they branched out very close to the ground, and it was impossible to get a clear tapping surface. When the trees were planted very close, say, at a distance of three feet, they had to grow upwards, and consequently a long clear tapping surface was obtained. The tree gave a good quality of rubber, but a much smaller quantity than Hevea. He described three methods of tapping which were used in the Belgian Congo. The first was known as the Schulze im Hofe, which consisted of vertical cuts extending from the first branch to the base of the tree and at about 4 inches distant, the collecting cups being placed at the bottom of the tree. The flow was at first very quick, but it soon dried up, and they had to wait about four months before they could tap again ; the cuts were made by incision. The second system was that known as the Christy, and this also consisted of a series of incision cuts, but on the herring bone system. The third system was known as Sparano, and this was similar to the Christy system, except that instead of making all the cuts on one day they were spread over ten days, two cuts being made in the tree every alternate day. The yield obtained by the use of the Schulze im Hofe system was 45 lb. per acre per year ; by the Christy method it was 88 lb. per acre per year ; and by the Sparano method it was 176 lb. per year. It was evident from this that the Funtumia would not yield so largely as the Hevea, as in the Belgian Congo they had been able to obtain yields two, three and four times as large as those obtained by the use of the Sparano system on the Funtumia trees.

In reference to the steam stump pullers, MR. LAPLAE explained that in the Katanga district of the Belgian Congo the forest had to be cleared to allow of cultivation, and it was impossible to use cattle on account of the prevalence of the tsetse fly. They obtained two engines from two English firms, and these were working very well. They consisted of ordinary traction engines of about 60 to 70 b.h.p., and attached to the front of them was a crane with a lifting power of from 3 to 5 tons. To the back of them was fastened a drum with a steel cable one inch thick and 200 feet long. They first experimented on pulling stumps, but afterwards they thought they could save the cost of labour involved in cutting down trees, and so they experimented on pulling up whole trees. The cable was attached as high up the stem as possible, and the moment the pressure was applied the tree came tumbling down—trees as large as they could imagine came tumbling down like a pack of cards—INDIA RUBBER JOURNAL.

TREATING LATEX IN LONDON.

The "FINANCIAL TIMES" of London states that a concern, known as the Robinson Securities Syndicate, Ltd., proposes to bring latex direct from the forest trees to the London manufactory, to be scientifically treated, so as to secure an evenness of grade. It is said that the transport of the latex to London in its natural state is a revelation, while the rubber already produced from such latex is reported to be of excellent quality.—INDIA RUBBER WORLD.

COCONUTS.

THE TREATMENT AND MANURING OF THE COCONUT PALM.

M. KELWAY BAMBER.

[*Paper read before the Low-country Products Association, July 3rd, 1914.*]

Before dealing with the treatment and manuring of the coconut palm it is perhaps advisable to briefly consider the various types of soil and the climatic conditions under which it thrives. In most tropical countries the palm is found to grow most luxuriantly near the Sea Coast where the contour of the land is generally flat, and where it is exposed to the effect of salt sea breezes during some period of the year. It grows best within a few degrees north and south of the equator. In several countries, including Ceylon, its growth has extended inland many miles from the sea, and it is now grown over large areas at elevations up to 1,600 ft. on soils totally different both physically and chemically to those found on the Sea Coast. In the Maldives and South Sea Coral Islands the coconut thrives on almost pure coral lime, while in Ceylon, it is generally grown on sands varying from pure white as seen in and around Colombo and Batticaloa, to dark grey reddish sands of the Chilaw and other districts. Further inland it is also frequently grown on alluvial banks of rivers, where it does well, and is also grown on cabooky soils which form the rising ground in most of the Low-country plantations. In the Malay States the palm flourishes on deep alluvial soil varying from coarse sands to finely divided siliceous silts almost of the consistency of clay, and of exceptional richness in plant food and with a rainfall of 65" to 80." Some of these soils contain from 8 to 55 times as much nitrogen as Ceylon sandy soils and 10 to 60 times more potash. In some instances the growth is even more rapid when there is a layer of jungle mould over the silt deposits. In the West Indies, Brazil and Central America it grows chiefly along the coast and in the former, healthy palms are said to average 100 nuts annually.

CLIMATE.

The climate of the coconut districts varies in different parts of the Island. From Colombo to Chilaw and thence to Puttalam the rainfall gradually decreases from 72·5" in Colombo, to 45·2" in Puttalam. The heaviest rainfall is in the North-East Monsoon from October to December, with a fair amount in April and May, the rest of the year being more or less dry, though rain falls every month. From Colombo to Galle the rainfall is generally heavier, 82" to 90" and better distributed throughout the year. Inland at Veyangoda and Kurunegala the rainfall is about the same as in Colombo and is fairly well distributed. In Jaffna, the rainfall is only 49" the greater part of this falling between October and December, June to September being practically dry. In Batticaloa the average is about 62" with a long dry period from February to September, and a wet N. E. from October to January. The sandy soils of Ceylon are usually found near the sea coast, but they also occur in the low lying portions of slightly undulating estates for many miles inland, and are formed by the breaking down of the cabooky soils, the finer

clay being washed away to the rivers and sea, and the sand collecting when the downward flow of water is temporarily checked. The Cinnamon soils, consisting of almost pure white sand are the poorest, and contain little available plant food, and although coconuts will grow in them, they will hardly yield remunerative crops until heavily cultivated and manured. The yellow, grey and reddish sands are usually a little richer in plant food, but even these may be classed as poor from a chemical point of view, and it is remarkable in many instances how good yields are obtainable from such soils. They consist of 93 per cent. of sand and only contain 0·311 per cent. of plant food altogether. Some of these soils are too poor even to grow grass for grazing purposes, and it is only by the enormous root development of the coconut palm through a large area that it can obtain sufficient nutriment for a healthy leaf growth and fruit production. The Maldive coral soils consist of about 90 per cent. carbonate of lime and are particularly rich in phosphoric acid, and in some cases in potash. It has been estimated by Lepine and others that a thirty year old coconut palm forms 2,240 pounds, or one ton, of organic matter during that period of growth, and absorbs from the soil from 228 pounds to 320 pounds of ash or mineral matter, consisting chiefly of potash salts, phosphate of lime and other lime salts, with a small proportion of sodium chloride and silica. The average composition of the ash of the whole tree is approximately salt 22·77, potash salts 132·00, phosphate of lime 92·00, carbonate and sulphate of lime 61·50, silica 13·20 lb. The greater proportion (or about 56 per cent.) of the potash and phosphate of lime is to be found in the leaves. Most of this is returned to the soil when the leaves drop off, and it shows the importance of utilising the mineral matter in the fallen leaves to the best advantage. A young palm about five years old was analysed at my Laboratory and the analyses of the various parts were very similar to those made by others. A feature of the analyses was the large amount of silica in the leaves, root, and stem, especially the two former, the silica amounting to 36 and 56 per cent. respectively. On carefully burning a portion of the leaf a skeleton of every cell is obtained, consisting chiefly of this silica. This shows that the roots of the coconut palm are able to attack the silica of the sandy soils more than most other plants. Lime is an important constituent, both in the leaves and stem, and to a less extent the root, while potash is chiefly in the leaves and stem, and phosphoric acid fairly evenly distributed throughout. Another constituent that is generally present in fairly large amount is sulphuric acid, so that the Calcium Sulphate in superphosphates and the sulphuric acid in sulphate of potash no doubt add to the value of these manures. Much of the potash but little of the phosphate of lime, is to be found in the immature fallen nuts, and here again the advisability of utilizing them as manure is indicated either before or after burning. The amount of mineral matter estimated to be removed from the soil by one acre of coconut palms annually at 62 palms per acre is said to be, salt 52 lb., potash salts 321, Phosphate of lime 194, carbonate and sulphate of lime 140, Magnesia 2, Silica 28, equal to 737 lb. The leaves and fallen fruits remove most, viz.—370 and 250 lb. respectively, while the trunk utilises 70 lb. and the remainder 47 lb. These figures show the importance of including a good proportion of lime potash and phosphoric acid in a manure mixture even for the growth of the palm, especially, if the soils are deficient in these constituents. But it must be remembered at the same time that the coconut palm roots penetrate through

several feet of soil, so that a comparatively poor analysis may still mean a very large amount of plant food. A foot of sandy soil over one acre weighs about 4,200,000 lb. and this increases with greater depth by about 7 per cent. per foot, so that at 4 ft. it would weigh over 5,000,000 lb. and the total 4 ft. of soil about

4,200,000 1st foot	...	5,040,000 4th foot
4,480,000 2nd ,,	...	
4,760,000 3rd ,,	...	18,480,000
	...	

18,480,000 lb. Taking an average poor sandy soil as containing 0·22 per cent. lime, 0·014 per cent. potash, 0·03 per cent. phos. acid, and 0·04 per cent. nitrogen, such a soil would contain to a depth of 4 ft. (and many roots go much deeper) the following amounts of essential plant constituents, though not in readily available form

Lime	...	40,656 lb.
Potash	...	2,587 ,,
Phosphoric acid	...	5,800 ,,
Nitrogen	...	7,400 ,,

Were all these constituents available, no manuring would of course be required, but they can only be released from their insoluble combinations by gradual decomposition with the aid of air, moisture and dissolved gases, chiefly carbonic acid. At the same time there would only be sufficient potash for about 16 years, and phosphoric acid for about 65 years, were it not for the return of the leaf ash to the soil annually. But apart from the composition of the palm itself the question of its remunerative cropping has to be considered. Several comparative analyses of the nut and husk have been made by Lepine, Bachoffen, Rideau and others, and the following may perhaps be taken as an approximate average :—

Husk	...	53·0 per cent.
Shell	...	12·6 ,,
Copra	...	18·5 ,,
Water	...	13·5 ,,

The chief ash constituents of the husk, amounting to 1·63 per cent. are, Salt 46 per cent., Potash 30·7 per cent., Lime 4·14 per cent., Phos. Acid 1·92 and Silica 8·2 per cent. The large amount of salt and potash in the husk is noticeable and would point to their value as manure. Copra ash amounts to 1·70 to 2 per cent. of the weight of dried copra and consists chiefly of phosphate of potash, potassium chloride, sodium chloride, and a small amount of lime, while sulphuric acid is unusually high. A candy of copra would contain about 10 lb. of ash consisting of 5·27 of potash, 2·03 of phosphoric acid, 87 of sulphuric acid, ·50 of salt, so that an average crop of 50 nuts per palm, giving say 3 candies of copra per acre, would remove from the estate nearly 16 lb. of potash, 6 lb. of phosphoric acid and about 11·7 lb. of nitrogen, the nitrogen content of copra being about 0·7 per cent.

To replace this in manure would require an application of a mixture somewhat as follows, applied every other year :

Sulphate of potash	...	32 lb.
Bone meal	...	27 ,,
Ground nut cake	...	167 ,,
		226 lb.

or say 3 1/5 lb. per palm.

To apply such a small quantity to large or old plants would however be absurd and there would be little visible effect on the palms. It has been found in practice that at least 4 or 5 times this amount, or say 12 lb. to 16 lb. per palm is required to render manuring profitable. It is very evident however that manuring as carried out at present must gradually and steadily result in an accumulation of plant food in the soil, if full use is made of the dropping fronds, immature nuts, etc. This again however depends on the character of the soil and the type of manure applied, and increase in reserve food would as a rule be more marked in retentive loamy soils, or the common cabooky soils than in the deep sands, which have little retentive power either for moisture or the soluble constituents of manure. The question of the use of soluble or insoluble manures on the latter class of soils is an important one, and experiments are being conducted to prove their respective values. It must be remembered that the root system of the coconut palm is different from ordinary trees, consisting as it does of a thick carrot shaped bole at the foot of the stem, from which as many as 2,000 roots start and penetrate the soil in every direction, the roots themselves branching at nearly right angles at varying distances from the stem or bole. Most of the roots if uninjured run for many feet and absorption of the soluble plant food takes place at the extremities of the main root or the smaller branches. The tip of the root unlike many other roots is devoid of fine hairs through which absorption usually takes place, but the extremity for about half to one inch consists of soft and easily injured tissue with a central group of fibrovascular bundles; behind this soft extremity the tissue rapidly becomes tough and fibrous. When cut through, the cut surface dries and shrivels, and new rootlets spring at right angles to the original, so that any temporary injury arising from ploughing or cutting circular trenches round the palms when applying manure is soon remedied. The idea that a cutting of the roots by digging or ploughing is harmful, is I think a mistaken one, though it should not be done at the beginning of the dry weather. By frequent disturbance of the surface soil the roots are driven downwards so that the palms are less affected by drought.

The wide dissemination of the roots throughout the soil would seem to point to the advisability of applying a soluble manure over a fairly wide area, commencing at some distance from the trunk, which when dissolved by the rain would soak into the soil around the root extremities, and be carried downwards and upwards through the soil as the weather was wet or fine.

As in sandy soils there is little retentiveness for chemical salts, and at the same time the formation of leaf and flower stalks is practically continuous throughout the year, it would also appear desirable to apply small quantities at frequent intervals to obtain the best return for the manure, rather than larger applications every second year. On the other hand the good effect of tying cattle to the trees for an occasional fortnight in the year, would tend to show that the soluble salts are retained, and the effect is more prolonged than the nature of the soil would lead one to expect, the beneficial results being chiefly due to the urine and soluble matters in the manure which soak into the soil.

That the coconut palm appreciates a continuous supply of readily available plant food is shown from the manner in which they flourish and crop heavily close to cooly lines or cooly houses.

So far the general practice has been to apply a practically insoluble mixture (except for the Potash salts) consisting of castor or groundnut cake, bone meal or basic slag, and kainit and other potash salts, frequently with 20 to 30 lb. of cattle manure in addition when available. Such a manure is applied every second year.

The results generally are satisfactory and have resulted in greatly increased yields especially after the second application, showing that insoluble phosphates, etc., can be easily utilised by the coconut palm. Mr. Rajapakse's results on one estate show an increase from 38,670 nuts in 1900 to 161,648 nuts in 1907. Still it remains to be seen whether frequent small applications of concentrated soluble manures would not give more rapid and equally satisfactory results than a large application of an insoluble manure every two years. The results so far obtained at Peradeniya on old palms rather point to this conclusion. A good deal of the first application of manures goes rather to increase the general vigour of the palm than to increase the crop, and for this reason it is advisable to make the first mixture rather more nitrogenous, though if a good proportion of phosphates are also given, the crop should also improve.

COCONUT NURSERIES.

G. PANDITTESEKERE

The first step to be taken is to find a suitable spot.

Select a place moderately shady; under coconut trees planted 26 feet apart would do very well. Land inclined to be low is preferable if the soil is not sour.

Having selected a suitable place cut a trench 12 to 18 inches broad, 18 inches deep and fifty feet long, put the earth on to one side, then start another similar trench immediatly next to this, fill the first trench with earth taken from the second trench, repeat this till you have trenched and filled an extent of land 50 feet by 50 feet (400 nuts could be placed within this extent). At the end, the last trench will be empty. To this transport the earth cut and put aside when opening the first trench. Collect some dry coconut leaves and cover this plot four to five deep and set fire. Prepare similar plots, leaving a 10 feet road between for carts to go through when removing plants.

SELECTING THE SEED NUTS.

Pick the second bunch off the trees when the crops are gathered once in two months. To be more careful let the bunches be lowered down to the ground with the aid of a rope and do not drop them on the ground as is usually done.

It is essential to remember that no nuts should be taken for nursery purposes from a less matured bunch than the one already described. I have found by experience that the plants of too matured nuts are always sickly, and that less matured nuts would sprout out fast and start dying equally fast.

The nuts for the nursery should be taken from trees that bear well, the stem of the bunches should be short, and nuts nestle close to the cabbage of the tree. (This will prevent the enormous use of supports now carried on in estates at great expense.) The nuts should be round with less husk and more nut. For this purpose walk round the estate and mark the trees that are suitable before having the nuts gathered.

There are different opinions as regards the position of placing the nuts in the nursery. I find the best results can be obtained by placing the nuts upright. When nuts are thus placed the young plant develops a fine large round stem and not the oval stem which is produced when the nuts are placed on their sides and the shoot is compressed by the hard husk on either side.

The nuts should be placed two feet apart from each other and three-fourths of the nut should be under the earth. Cover the nuts thus planted with coconut branches about 3 feet, and water the nursery twice a week when there is no rain.

My last nursery worked in this way gave excellent results, even after going through a rather severe drought. The plants at the age of six months were 4 feet 1 inch high with the nut, and the stems were $4\frac{5}{8}$ inches in circumference with five branches. This nursery was put in a neglected old coconut plantation which had seen no kind of attention for the last thirty years.

Great care should be taken when removing the plants from the nursery. The cooly should be made to make use of his mamoty more than his hands. To pull the plant by the stem will do much damage. 90 per cent. of the plants that die at transplanting could be prevented by careful removing of the plants from the nursery.

After the first best set of plants have been taken from the nursery there will be a few more healthy plants but not grown up high enough. These will grow up as soon as the nursery is thinned. The plants that are not suitable after the second selection should be destroyed.

It is often the custom of the poor villager to take these bad plants and plant them in their little holdings. This should not be allowed.

THE RIPENING COCONUT.

The changes which occur in the ripening coconut are summarised as fol lows in the PHILIPPINE AGRICULTURIST AND FORESTER:—We may divide the growth into three periods. During the first period there is an accumulation of invert sugar and amino acids in the milk or watery portion. The meat is still absent, the shell and husk are soft and watery, and the nut as a whole has its greatest diameter along the main axis.

During the second period of growth sucrose appears in the milk and the specific gravity of the latter is high. During all this time water is lost from the coconut, though its total weight continues to increase. The nut has meantime changed its shape, and begins to acquire its greatest diameter in a direction at right angles to the main axis.

During the closing period of ripening there is a sudden rise in the content of oil in the endosperm. The specific gravity of the milk falls at the same time owing to the transfer of nutrient materials or to respiration. In the meantime the shell has become impervious, and the drying out of the husk results in a loss in weight, which over-balances the gain in weight due to other changes.

The coconuts on which this work was undertaken are in no way representative of really good nuts. The soil on which they grow is shallow, and the trees are poor individuals. The analyses are therefore not expected to be representative of average coconuts.

CACAO.

CACAO FERMENTATION.

ARTHUR W. KNAPP, B. Sc., LONDON.

(Continued from Page 17.)

HOW TO SUCCESSFULLY FERMENT SMALL QUANTITIES.

It is sometimes said that it is impossible to obtain a good fermentation in a box smaller than a cube 4 ft. each way. It is true that the results are unsatisfactory unless special precautions are observed to prevent the escape of heat.

FERMENTATION OF SMALL QUANTITIES.

Position.	Box, 3 ft. × 2 ft. × 2½ ft. Unprotected	Barrel, length 2 ft. 2 in., diameter 1 ft. 4 in. In a shed	Box, 1 cubic foot. Embedded in a large mass of beans.
Temperatures. ...	Degrees Cent.	Degrees Cent.	Degrees Cent.
After 1 day ...	26	27	32
,, 2 days ...	27	33	39
,, 3 ,, ...	32½	41½	46½
,, 4 ,, ...	32	47	48½
,, 5 ,, ...	34	48	50

These results show that it is not the size of the box, but the amount of protection from cooling, which determines the temperature and fermentation. The beans in the unprotected box were not fully fermented. Those in the barrel, which was protected from air currents by placing in an unused sweat-box, were well fermented and plump, and were equal in every respect to those obtained by fermenting 10 cwt. lots. When roasted they produced an equally good cocoa.

When fermenting small quantities, such as would produce 50 to 100 lb. of dry beans, they should be placed in a box which they almost fill. The box must be first lined and the beans well covered with banana leaves. The box should be placed in another box somewhat larger and prevented from touching the bottom by resting on logs. The outer box should also be similarly raised and both boxes should be slightly perforated at the bottom to allow the sweatings to escape. The whole should be covered by a loosely fitting lid, and may be freely exposed to the sunlight to keep warm. Small quantities are apt to dry up before fermentation sets fully in, so that the first two days' sweatings should be collected in a clean vessel and

sprinkled over the beans. (If there is little pulp on the beans a solution of glucose, where available, may also be used.) After the first two days the beans should be emptied into the larger box, mixed, and put back into the smaller box. This should then be repeated each day.

THE PODS.

These should neither be unripe nor over-ripe. It is immaterial, however, whether they are just full and mature, or quite ripe. The following analyses, which were very kindly done for me by the Trinidad Department of Agriculture, show that one of the most important constituents, the fat, is practically the same in both cases. The two pods (Calabacillo) were taken from the same tree.

BEANS (SHELLED) IN THEIR NATURAL CONDITION.

	Full pod.	Ripe pod.
Water ...	35·12 per cent. ...	30·64 per cent.
Fat ...	36·70 per cent. ...	39·20 per cent.

BEANS (SHELLED) DRIED AT 100 DEGREES CENT.

Fat ...	56·56 per cent. ...	56·51 per cent.

USE OF PLACENTA OR "GUTS."

It is contended by some planters that leaving in the placenta improves the flavour of the bean. Their presence in the sweat-box is certainly very useful when the pulp on beans is dry. They should, however, be pulled apart from the beans, as otherwise the beans which remain fixed to the placenta do not get thoroughly fermented. The improved fermentation compensates for the trouble of removing them during drying.

COVERING.

Sacking is used by some planters, but its use cannot be recommended. It soon becomes very dirty and is liable to produce mould. It is usual to leave the beans uncovered the first night, thus the planter allows the minute yeast cells floating in the air to settle upon them.

TURNING.

Only a few planters "turn" the beans every day. Whilst this is not absolutely necessary, it ensures even fermentation. There is a *loss of heat* on turning, which varies roughly with the time taken and the temperature of the surroundings.

LOSS OF HEAT ON TURNING.

Weight of Cocoa.	Before.	After.	Loss on Turning.
	Degrees Cent.	Degrees Cent.	Degrees Cent.
9 cwt. ...	49 ...	39 ...	10
1 ,, ...	48 ...	41 ...	7
9 ,, ...	46 ...	43½ ...	2½
9 ,, ...	39 ...	36 ...	3

LABOUR SAVING.

The present method of turning is slow and laborious. It would be rendered easier :—

(1) If the sweat-boxes were built upon a hill, or a made inclined place, the bottom of the first box being level with the top of the second, the bottom of the second level with the top of the third, and so on, the boards at the sides of the boxes being as usual, removable ; or (2) a false floor, about half the width of the true floor, might be arranged in each box, so that it could be raised through the beans by means of weighted ropes over pulleys. By this device mixing could be accomplished in five minutes.—TROPICAL LIFE.

(To be continued.)

FRUIT.

THE PINE-APPLE INDUSTRY.

Mr. John Macfarlane contributes an interesting paper to the Tea and Coffee Trade Journal for June last on the World's trade in pine-apples. He traces the appearance of the pine-apple in India as far back as 1548 and refers to the first fruit grown in England as having been raised in the hot house of the Duchess of Cleveland and presented to King Charles the Second.

The trade of the British West Indies has shrunk, and the European markets are now supplied with fresh fruit mainly from the Azores, while Hawaii and Singapore are responsible for the bulk of the canned product. Of recent years Porto Rico and Cuba have developed an extensive trade in both fresh and canned fruit, while Florida also contributes a fair share. In the last mentioned State there are acres of shed-protected fields, the sheds being covered with canvas during frosty weather.

In Hawaii there were 1,600,000 acres under pine-apples in 1913, the rows on some of the plantations extending to 2½ miles in length.

The following details of the method of canning the fruit will be read with interest :—

In canning pine-apples the first thing is to remove the rind. To do this the fruit is placed horizontally between two pin clutches, which pierce the ends of the fruit. The pine-apple is made to revolve by throwing the machine into gear just like a lathe, and an operator manipulates a knife which removes the rind, cutting deep enough to take out all the eyes lying under the outer skin. As these penetrate some distance into the fruit, the loss of pulp with the rind is considerable, although a part of the pulp is recovered in a subsequent process called grating.

The pine-apple is removed from the machine, the ends cut off and the fruit trimmed a little and then passed on to the corer and shaper. This machine removes the core and shapes the fruit to uniform size. The waste from this process, chiefly the core, goes directly to the dump car, although occasionally it is canned separately for confectioners' use. The fruit then passes through the cutting machine, which cuts it into uniform slices; these are carried along a conductor, sorted and put into cans. The cans are then partly filled with sugar syrup, passed through a steaming apparatus, closed and run to the cooker. When the cans are cooled after leaving the cooker they are ready for labelling and packing for shipment.

The fruit is put up in three ways—sliced, as has been described, and also in a crushed and grated form. The crushed and grated forms are used largely for pies, cakes, puddings, ices and for all cooking purposes.

C. D.

BANANA CULTIVATION.

(*Continued from page 37*).

PRUNING.

After the first plants have fruited, it is more difficult to time the fruiting of the ratoons, and the art, the skill, of the Banana grower comes in, in getting his fruit in, in the season, that is during the months of the highest prices. This is not to say, that any growers get all their fruit in then; in spite of all care, the bananas are subject to the control of the weather, and too much wet or too much dry or wind, and also errors in pruning them, throw them late, and some stems are fruiting all the year through; but the bulk of the crop is aimed to be got in between March and June. Many of the smaller planters however, do not yet understand the necessity of pruning nor the art of it and are content to take the bananas when they get them. Left to themselves most of the bananas would fruit in the hot months between July and October. It is always an artificial forcing to get most of them to fruit in the spring.

A ratoon is an offshoot or sucker from a growing plant. The young offshoots or new suckers come up from the soil as "Peepers" a very descriptive term. As they grow up in the shade of their parent, as they may be called, the leaves do not expand in the way a young plant banana growing from a planted bulb or head does; the Peeper is stout at the base and tapers to a peak, later on slowly and very gradually opening out into leaves as it gets 4 to 6 feet high—depending upon the thickness of the shade. This until the leaves expand is called a "Sword" "sucker."

These ratoon suckers are very slow to grow, as they are playing second or third fiddle to the larger plants from which they are the offshoots, and so not only are they in heavy shade but their roots have to compete with the roots of the others already established. Their growth depends too on the state of the soil; if kept loose simply by breaking the surface crust, which tends to bake and harden close to the plant, their roots can grow more easily.

The first banana plant from the bulb or head, planted say between January and March of one year in good soil, should have all the young suckers which spring from it cut out with a machete or cutlass until August when the little satoon suckers peeping from the soil should be carefully examined; the best one or two of these should be left as ratoons, the other Peepers should be cut out. By the time the bunch was cut on the first plant, say in March, the first or second ratoons would be man high to the break of the leaves, that is, where the leaves unfold from the stem. Cleared of the shade of the large plant when the bunch is cut they would then grow very quickly with the heat of the summer, and by October should be full grown. After October or the middle of November, the weather is much colder, and there is less growth so by that month the bananas should always be aimed at to look full grown, ready to shoot. Out of the plains there is little growth in the winter months, and if the banana shoots in November or December, the bunch will be slow to mature and will not be ready before March.

From shooting (the term used when the inflorescence or flowers of the banana appear out of the heart of the growing plant) to being full enough to cut takes at least three months under the best conditions, but where the bananas are dense, or in October, November, December and January, the time is four months: in the hills a mon longer.

All along young suckers (offshoots) will be growing up especially in rich soils where growth is exuberant, but these have to be cut out or pruned at intervals, so as to regulate the growth. After the first year the growth is slower, and "Peepers" (which were left on the first plant in August or September) should not be cut out after April in order to give a selection when they are a foot high in July and August or under best conditions September, at which time only those aimed to fruit eighteen to twenty months later are left. The growth of these is very slow. Such young ratoons should always be left on a growing stem if possible not on one from which the fruit has been cut.

The bunch on the first plant should be ready to cut between March and June, the follower aimed to fruit the following year, by then should be man high; with "Peepers" just coming through the ground at the side of the follower.

In October the first ratoon plant (which was the first "Follower") would appear full grown, and the Peeper which is the second ratoon plant about knee high. Of course many suckers will spring but a selection of one "Follower" and one "Peeper" is made, as well placed as possible.

This is where bananas are rigidly pruned for the spring crop alone. As we have stated, in rich lands or in forcing climates 2 or 3 suckers are allowed to grow at one time. These are fortunate estates. Many soils can carry a succession of suckers, one bunch being cut in spring, another in August or September another again in the following spring. In this case a follower or second sucker would be allowed to grow 2 or 3 months after the first got a good start.—JAMAICA AGRIC. SOC. JOURNAL.

INDIAN CONDIMENTS.

TO THE EDITOR, TROPICAL AGRICULTURIST.

DEAR SIR,

In the interesting article taken over from the GROCERS' JOURNAL on Indian Condiments, appearing in the TROPICAL AGRICULTURIST for June 1914, the mango is said to be the foundation of all Chutneys. This is not correct. There are various kinds of Mango Chutney, but there are other chutneys in the preparation of which mango is not used at all, e.g., Tamarind and Lime Chutney.

"Poppadams" are described as a thin paper-like biscuit. It may be added that it is prepared from meal obtained from the *Phaseolus radiatus* bean, a fact not generally known.

For making curry something more than curry-powder, which is a mixture of different condiments—chiefly coriander and chillie with cummin and spices—is required, viz. "curry leaves," such as *Morynga koenigii*, *Andropogon citratus*, and *Pandanus latifolia*. Without these "leaves" the true curry flavour cannot be got.

Yours truly,

D.

SOILS AND MANURES.

THE USE OF FERTILISERS.

A recent issue of the PHILIPPINE AGRICULTURIST AND FORESTER contains a valuable contribution on this subject by "E. B. C." whose initials will be readily recognised as those of a writer whose opinion on such matters is entitled to respect.

The title of his article is "Caution in the use of Fertilisers" which is not adopted here as it is likely at first sight to mislead some people into thinking that the writer is inclined to discredit the manuring of the coconut palm to which he particularly refers, or that the use of fertilisers is fraught with danger.

In reality what he desires to impress on the planter is the need for a rational system of manuring based upon experience and a full consideration of local conditions, so as to secure the best results at the smallest cost. The article, which is reproduced in its entirety, is well worth the careful study of the planters.

The use of fertilisers is often regarded as the most essential and characteristic feature of the practice of scientific agriculture. Courses of agricultural instruction usually give much more attention to this than to any other part of the subject. There are various books and good books, devoted to the subject of fertilisers and their use. Every general treatment of one of our crops devotes much attention to this phase of its proper culture. In one book on the coconut, there are nearly 150 pages devoted to fertilisers. The planter is continually urged to use them, and the favourable experience of those who have done so is constantly invoked for his guidance.

There is no question as to the general possibility of securing by means of fertilisers greater yields than will be obtained without them. There is likewise no question as to the profits which can usually be obtained by the judicious use of fertilisers. Neither is there any doubt that such manures as are produced on the farm can be used to good purpose as fertilisers, and that failure so to use them is always very wasteful.

Nevertheless, the dogmatic treatment which the subject often receives in editorials and appeals to the farmer, and in many other places, is thoroughly misleading. There are two general reasons why this is so. In the first place, the evidence is not what it seems to be. It is the almost universal custom outside of well conducted experiment stations to apply fertilisers to the land, to observe the increase in production of crops, and to construe this as measuring the profit. It needs no consideration to show that increased yield and increased profit are by no means the same thing. Before a profit from the use of fertilisers can be computed, the farmer must, of course, take into account the cost of fertiliser, and the cost of operations incidental to its use, such as for instance harrowing it into the ground. In careful work there

must still be considered interest on the money tied up, the future value of fertilisers still remaining in the soil, and the value, independently of fertilisation, of treatment given incidentally to the use of the fertiliser. It is rare indeed to find a farmer who keeps his books in such a way that he knows at all accurately what the application of fertilisers has cost him. Even the manure of his own stock is rarely applied without some expense, whether for fencing, herding, hauling, or otherwise.

There is no kind of experimentation which requires more perfect understanding of the subject and knowledge of possible sources of error, and care in guarding against unreliable results, than does the testing of the value of fertilisers. In such experiments, when carried on as field or plot cultures, the soil takes the place of the chemist's laboratory apparatus, and the soil is complex far beyond anything in the chemist's laboratory. The gross chemical composition of the soil is easily determined and is reasonably stable. But the individual constituents as chemical compounds fluctuate from day to day. These fluctuations are partly understood and are partly under control.

It is generally believed by those who are not professionally acquainted with the subject, that it is possible to determine by chemical analysis of the soil what fertilisers, and how much of each, can profitably be applied to it. This is sometimes the case, but it is a rare one. Soil analysis may reveal such scarcity of nitrogen, or potash, or phosphorus that one may safely conclude without any other evidence, that one of these substances will produce such results as are sure to be profitable. Much more commonly this is not the case. The soil analysis is likely to indicate what experimental tests are most likely to be worth while, and these experimental tests will then be a guide to the use of fertilisers on the farm.

There are many reasons why the analysis alone is not a safe guide for the application of fertilisers. It has already been mentioned that the elements in the soil are constantly re-arranging themselves. What is present in the soil is of value to the farmer only as his crops take it up and use it. The crops take all of their food from the soil in solution in water. Any compound in the soil is available when it is dissolved and unavailable when it is not dissolved. The extent to which the food materials in the soil enter into solution depends obviously on the amount of water present. In the soil of most farms and of the best coconut plantations there is moving water which brings into the soil about the trees food material from other places. However poor chemical analysis may show such soil to be, the trees are well nourished, and the use of fertilisers is very likely to be unprofitable. The application of fertilisers, guided by chemical analysis, but without taking into account the water supply of the soil, is, therefore, irrational.

Crops differ considerably in the demands which they make upon the soil. Some of them have deep root systems, and can accordingly take up food at depths down even as far as two meters. Others have the roots very close to the surface; for those, deep-seated stores of food are available only as the substances come toward the surface of the soil, in solution. Some plants are conspicuous for the quantity of single food element which they require. These peculiarities of individual plants are always taken into account in applying fertilisers to crops of temperate lands. In the tropics it is customary to attempt this; but as a matter of fact our knowledge of the

requirements of most of the staple tropical crops is altogether inadequate in this respect. We have no such analyses, that is, no such large number of analyses, of coconut trees, or their leaves, or nuts, or of the abaca plant or fibre, that any man can say with confidence that either of these plants needs to take up any particular amount or any particular per cent. of any single mineral food. It is sometimes possible by analysis of the plant, or the marketable product of the plants of various temperate crops, to ascertain that some mineral food is not present in normal amount, and, therefore, to decide that this food could be profitably applied as a fertiliser. The knowledge obtained by analysis of the plant is in such cases a very much safer guide to the use of fertilisers than is the suggestion afforded by chemical analysis of the soil.

The second objection to the evidence at hand demanding the use of fertilisers on our crops is the fact that there is not taken sufficient account of the extreme variability of local conditions. The world's study of fertilisers has been made in Europe and the United States. In the central United States observations made in one spot are usually valid ten miles away, often one hundred miles away, or even more. The soils and climate have been so perfectly studied that the intelligent farmers can easily know whether or not the results obtained at his state experiment station are immediately applicable to his own farm. In the Philippines there is an astounding local diversity of soil. At this College it is difficult to secure a square tract of one hectar on which soil conditions are so uniform that one part furnishes a valid check for all others. The variable climatic factor is water. Its variations are not so intensely local as those of the soil except as the water varies with the difference in the soil. Still there are places in the Philippines where at sea level the rainfall at points 20 Kilometers apart varies in the ratio of fully 3 to 1.

Under such conditions the individual planter should take experience in other places as a guide to experiments, but cannot without risk take it as a guide to practise on a large scale.

With all of this, I do not intend to discourage the use of fertilisers. Their proper use would be one of the greatest possible improvements in the agriculture of most parts of these islands. There are provinces in which the staple industry will be improved by their judicious use more than in any other one way. There are probably few farmers in the whole Archipelago who could not increase their profits if they know how to use fertilisers to the best advantage. But while they do not know what fertilisers are most needed, what forms can best be secured, when and how they should be applied, and what results can reasonably be expected from their use, the time for their widespread application has not arrived. Their use on a large scale, with confident expectation of profit, would merely result in the majority of cases in disappointment, and in the establishment of prejudices, which would be very difficult to remove, against their further employment.

In securing the adoption of any improvement in agriculture, haste must be made slowly. This is true when those who give advice are sure of their ground. When experimentation itself has not passed the earlier stages, it is not time to make haste at all. The time is always here to encourage the farmer to experiment when he does this understanding that he is making experiments, and that it is not in the nature of an experiment that the results

should be known in advance. He can be told with confidence that it is possible for him to use fertilisers with profit. He can also be told how to find out how to do this. In many places, it is now possible for the government, through field representatives of its bureaus, to help the farmer plan his experiment, so that it will be most likely to show how to use fertilisers profitably.

The most rapid possible advance in the use of fertilisers in these lands will be by enrolling the farmers as experimenters, by helping them to institute and properly control their experiments, and by taking care that they understand that failure with one fertiliser and in one place is no more reason for discouragement than success with another fertiliser and in another place is a reason for the general adoptionof locally successful methods.

Finally, it must be understood that many experiments prove nothing whatever, and that this is especially true of experiments made by those who are not especially expert in such work. So long ago that every individual concerned has now left the Philippines, I saw an experiment made on the fertilization of the coconut by means of ashes. These ashes were applied to two parallel rows of trees running east and west. During the succeeding few months the trees of the south row which had received the ashes, exceeded the other row remarkably in production. This fact was duly reported as a most instructive demonstration of the value of ashes as coconut fertilisers.

The fact was that the trees of the south row were an average of 3 or 4 meters higher than those of the north row, and that they were at all times correspondingly thriftier. The experiment included the winter months when the south row shaded the north one to a considerable extent. But if the experiment had been properly started, the trees of the two rows exactly alike and equally exposed to all outside conditions except the fertilisers, it would still have been true that the application of the fertilisers could have had no appreciable effect on the production during the time the experiment lasted.

There have been reported to me the results of two other experiments on the fertilisation of coconut in these islands. In both cases, the supposed improvement was observed before it possibly could have been due to the fertilisers applied. In all of these cases the treatment was probably beneficial, so that good happened to result from the accident; but the observed results were none the less accidental.

Men are not so quick to tell about their mistakes as about their successes and it is probable that at various times fertilisers have been applied, and decided to be valueless or injurious; and that the subsequent thrifty growth and production,—for which the fertilisers were really responsible,—have been construed as evidence of recovery.

The first essential in any scientific agriculture is the understanding of the ways of the plant.

DURATION OF THE ACTION OF MANURES.

A. D. HALL

The facts already brought to light by the experiments upon the Little Hoos Field at Rothamsted may be summed up as follows:—As regards farmyard manure, the nitrogenous compounds introduced by the consumption

of cakes and other concentrated feeding stuffs have to be distinguished from the compounds derived from the straw and the undigested residues of such coarse foods as hay. The former will have an immediate effect on the first crop, and to a much smaller extent on the second crop, after which they disappear. The latter compounds act slowly, do not waste, and have a measurable value for many years, though for practical purposes their action after the fourth year may be neglected.

Among nitrogenous fertilisers, ammonium compounds and nitrate of soda have no perceptible action after the first year. Peruvian guano, rape cake, and similar fertilisers containing proteins leave very little residue after the first year, and none after the second. On the other hand, nitrogenous fertilisers of the wool, hair, and bone class are slow-acting and non-wasting, and their effect may be expected to persist for at least four years.

Phosphatic fertilisers, even when soluble like superphosphate, do not waste in the soil, and their residues continue to be effective until they have been exhausted by the crops.

In view of the fact that the wastage in the residues of active nitrogenous fertilisers takes place during the winter, it would be of great advantage, especially on rich soils, to grow a catch crop before the winter and so convert these nitrates, etc., into insoluble plant material to be afterwards ploughed in to become available for another crop.—JOURNAL OF THE BOARD OF AGRICULTURE.

THE ACTION OF MANGANESE IN SOILS.

The effect of manganese on poor and good soils was studied by growing wheat in pots. Manganese chloride, sulphate, nitrate, carbonate, and dioxide had a stimulating effect in the case of an unproductive sandy loam soil. The best results were obtained when the salt was applied in amounts from 5 to 50 parts of manganese per million. Quantities higher than this gave no correspondingly larger increase and in some cases were even harmful. On a productive loam the various salts of manganese had no stimulating effect.

Further work was done by growing the crop in treated aqueous extracts of soils and studying the oxidizing power of the plants. The oxidization was tested after the plants had been growing for two weeks. The effect of manganese on the oxidizing power of the plant roots and on growth gave different results with different soils. With poor, unproductive soils manganese salts increased oxidation and growth. This was especially true in extremely poor soils and in a soil in which were found several harmful organic compounds. Oxidation was increased in productive soils ; the growth, however, was decreased ; the plants gave indications of excessive oxidation, and as the oxidation processes in these soils were already good the harmful action is attributed to excessive oxidation.

It is explained that the beneficial action of manganese may be due to its function of aiding and increasing the oxidation processes and other vital processes in the plant as well as in the soil, and by this means changing or destroying some noxious products detrimental to plant growth.

A five year field test with manganese sulphate at the rate of 50 lb. per acre was carried out on a silty clay loam soil, the crops grown being wheat, rye, maize, cowpeas and potatoes. The crop yield was decreased and the oxidizing power of the soil (which was not very strong) was lessened. The catalytic power of the experimental plots was slightly, if at all, increased. The soil was, however, of an acid nature, and was therefore unfavourable to oxidation and catalysis. It is concluded that manganese is not profitable on soil of this nature in need of liming.—JOURNAL OF THE BOARD OF AGRICULTURE.

STERILIZATION OF SOIL BY LIME.

H. B. HUTCHINSON.

The known actions of lime in improving the physical condition of a soil, neutralizing acidity, and rendering plant foods available by chemical action are not sufficient to account for many of the results obtained in practice by the application of lime. It is now shown that caustic lime in sufficiently large quantities produces effects intermediate in character between those produced by volatile antiseptics and those induced by high temperatures. The larger protozoa and many bacteria are killed, and the organic nitrogenous constituents of the soil are decomposed. When all the lime has been converted into carbonate, a period of active bacterial growth ensues, with increased production of plant food. Pot experiments gave results in agreement with those of bacteriological and chemical analyses. A poor arable soil, containing a sufficiency of calcium carbonate, gave increased yields after application of 0·5 per cent. of caustic lime. A rich garden soil after the application of lime (up to 1 per cent.) gave decreased yields in the first crop, but largely increased yields in the second crop.—EXPT. STATION RECORD.

JAPANESE FERTILISERS.

J. STRUTHERS.

The use of commercial fertilizers in Japan is of comparatively recent date, but is rapidly assuming large proportions. The estimated total value of fertilizers now used is from $34,860,000 to $39,840,000 annually. The use of commercial fertilizers is supplementing, and to a considerable extent, superseding the older practices depending upon the use of night soil, straw ashes, and similar fertilizing materials. The use of animal manures has played a comparatively insignificant part in Japanese agriculture because the number of animals is small and the manure is usually poor in fertilizing constituents. Green manuring, especially with green grass, *Astragalus sinensis* and *Medicago denticulata*, is practised to some extent. Japanese soils are not naturally very fertile and the system of continuous cropping which prevails is very exhausting to the land, hence the free use of fertilizers has been followed with very profitable results.

The imports of fertilizing materials into Japan are large and include all of the usual fertilizing materials, mixed and unmixed, besides a variety of oil cakes and miscellaneous materials. German potash salts have only recently been introduced and their use is still limited chiefly to a small amount of sulphate of potash. The home produced fertilizers include various kinds of oil cakes and fish manures, bone, hoofs, horn, hair, rice bran, by-products from the soy, the sake, the beer, and other industries, wastes from silkworm rearing and cocoons, a little sulphate of ammonia from gas works, a small amount of calcium cyanamid, besides superphosphates and mixed fertilizers of different kinds. The principal centres of fertilizer manufacture are Tokio and Osaka.

The Osaka fertilizers were originally made largely for use in aquatic agriculture (rice and rushes) and were compounded chiefly of ammonium sulphate and superphosphate, a mixture which seems to be best suited to soils in which the transformation of nitrogen does not, as a rule, go beyond the ammonia stage and which "does not have the same ultimate acid effect as would the same combination of manures applied to dry land crops.....Partly from geological reasons and partly from manuring practices long continued, most soils in Japan have a tendency to become acid and this is more marked .....in the case of non-irrigated fields.....In the manuring of rice Japan is very far in advance of any other rice-growing country, in the manuring of mulberry Japan has no equal, in the manuring of tea she is behind Ceylon and in advance of China, and in the manuring of sugar cane considerably behind Hawaii and in advance of the Philippines. Only within recent years has the manuring of the winter cereals, barley and wheat, received serious attention."—EXPT. STATION RECORD.

BACTERIUM RADICICOLA.

A. J. EWART AND H. THOMSON.

Experiments are reported which were conducted to determine whether the bacteria from the root nodules of native Leguminosæ are capable of directly infecting cultivated species, such as alfalfa, peas, clover, beans, vetch, etc. Inoculation material was taken from root tubercles on 5 species of native plants and cross-inoculated on 8 cultivated species, the experiment being performed twice during the period from November, 1911, to June, 1912.

Of 80 different lots of plants, only two, both of which were clovers, showed any indication of nodule development. Although no nodules were present on the roots of the other plants in the inoculated series, yet the plants showed better growth and were larger and much stronger. Whether this was due to the root nodule bacteria continuing to live in the soil and fix nitrogen outside of the plants was not determined.—EXPERIMENT STATION RECORD.

APICULTURE.

ROBBER BEES.

Robber bees are not a different kind or strain of bees, as some bee-keepers assume; they are merely bees which have discovered that it is easier to carry home honey, the finished product, than to fly long distances to collect the raw material, the nectar of flowers, which, after it is taken into the hive, has to undergo a process of concentration and a chemical change, brought about by the addition of a nitrogenous secretion from the body of the bee. It is the presence in honey of this nitrogenous matter (albumen) which causes the excitement and the inclination to sting when bees find honey somewhere instead of nectar. When the available supply is exhausted, the bees will search near and far for more, and as they are guided by the sense of smell the odour of honey attracts them to the entrances of other hives, or bees' nests in trees, and finding some poorly defended stocks they enter and empty the combs of the last drop of honey. Becoming bolder, the robbers next attack stronger colonies, with the result that much fighting takes place, and many bees are lost by stinging. Robbing, as a rule, starts during a dearth of nectar, or a temporary break in the honey flow; but once bees have been robbing for some time they will continue, even when nectar is plentiful again, and it is about as difficult to cure them of the robbing habit as it is to break a dog of worrying sheep, or a hen of eating eggs.

CAUSES OF ROBBING.

There are quite a number of causes which develop the robbing habit in bees; the underlying factor in every instance, however, is that the bees find or scent honey instead of nectar. (1.) Bees should on no account be allowed access to honey outside their own hive. The decimation of box hive bees over the larger part of Australia during the past 30 years is almost entirely due to the practice of letting the bees clean up rejected combs, sticky boxes, and utensils after the hives have been robbed of their contents. If one of the robbed hives happened to be diseased, many, or all the colonies, would get a share of the infected honey, while bees from trees or neighbouring farms would also take part, with the result that foul brood almost annihilated bees in some districts. (2.) Feeding bees outside the hives during a dearth of nectar, or, indeed, at any time, is a bad practice, and frequently causes robbing to start. If it is necessary to feed it should be done inside the hive, a proper feeder being used, and sugar syrup given, not honey; the former is just as good as honey, is cheaper, safer, owing to the absence of possible disease germs, and does not excite the bees so much, as it does not contain any nitrogen. Even then it is best to give the syrup towards evening, so that bees from other hives may not be attracted. (3.) Combs in hives, the walls of which are too thin, sometimes melt down in hot weather, and the honey running out, attracts bees from other hives. (4.) Weak colonies, which are unable to guard the hive

entrance efficiently, or queenless colonies, which will admit strange bees, robbers included, without hindrance, may also, during a scarcity of nectar, cause an outbreak of robbing. (5.) Unseasonable operations are frequently the cause of robbing. Shaking the bees off the combs in front of the hive instead of into the hive, and thus spilling thin honey on the ground, extracting honey in the open air, or in a non-bee proof room, and returning extracted combs to the hives, are all operations which are quite harmless during a honey flow, but which, after a change in the weather, may create quite an uproar in the apiary. The secretion of nectar by the blossoms sometimes suddenly ceases when extracting still has to be done, and it is, therefore, best to have a bee-proof place to extract in, to shake the bees off the combs into the hives, and not to put the extracted combs out till towards evening.

RESULTS OF ROBBING.

It has already been stated that robbing has caused, and, it may be added, is still causing the wholesale spread of the diseases of bees, and while the loss of many colonies from foul brood is the most deplorable of the results, there are others, some of which are annoying, while others add expense to the running of an apiary, or reduce the returns. Robbing is almost invariably accompanied by the stinging of man and beast in the vicinity of the hives, while sometimes the actual loss of bees stung to death is considerable.

When an apiary has become demoralized through robbing, even bees, which, by mistake or on account of strong winds, enter the wrong hive are stung to death, when under ordinary conditions they would be accepted. It is stated in some bee books that every bee knows its hive, but every careful observer who has kept several distinct races of bees in the same apiary knows that there is considerable straying of bees from hive to hive. In a demoralized apiary, every strange bee entering a hive is stung, and large numbers of dead bees may be seen in front of every hive long after actual robbing has ceased. Further, when bees are in this state of irritation they will sometimes ball their own queen, or, if a virgin, cripple her so that she is unable to take her mating flight, or destroy her altogether, so that the colony becomes queenless, and a further inducement to create robbing. At such times attempts to introduce new queens are sure to result in failure, the owner of the bees being at a loss how to account for it.

PREVENTION OF ROBBING.

In regard to robbing, as in other things, prevention is better than cure. If the extent to which bee-keeping is carried on does not justify the erection of a special bee-proof extracting house, at least a place should be set apart which can be made bee tight in which to carry out all the operations of uncapping, extracting, and tinning of honey, and to store combs, wax, and appliances. Even a tent may, with little trouble, be made bee-proof. For the specialist bee-keeper, a properly constructed honey house is an absolute necessity, and a good investment, as it enables him to catch up with the work of extracting during short breaks in the honey flow, when otherwise he could not do so without demoralizing the bees. When more than twenty hives are kept, a wheel-barrow carrying four supers of combs, will

save much time and hard work, and at the same time exclude the bees from the combs during the taking of the combs from the hives and on the way to the extractor. This is accomplished by having a board the size of the hive body, with a rim round the edge, on the barrow to catch any drips of honey, and a light cover on the top, which is raised and dropped again every time a comb is inserted. If robbers are very persistent, and try to rush the combs every time the cover is raised, they may be circumvented by using two smokers, one at the hive, while the other, with the top open, is placed on the ground inside a hive body, another body is placed on the top, into which the combs are hung as they are taken off the hive ; no cover is needed, as the smoke rising between the combs keeps the robbers away. When the box is full it is lifted on to the barrow and covered up. In this way honey may be taken off and extracted at times when it would be impossible to do it in the ordinary way without starting robbing, stinging, and general confusion amongst the bees.

Water in which sticky utensils have been washed, or the water used in boiling up old combs or beeswax, should be buried, while the refuse from the wax press, or the bag in which wax has been boiled under water, should be burned. The exercise of these precautions will keep the largest apiaries in a normal state, and enable all work to be done in peace and comfort.

TO STOP ROBBING.

When robbing has only just commenced it may often be stopped. If a weak hive is being attacked, the entrance should be contracted, to give the defenders a better chance of repelling robbers. If robbers are hovering round or bunching on the crevices between the lower and upper story, a little kerosene or carbolic acid applied to the wood with a brush will cause them to desist. If contracting a hive entrance is not effective, the same remedy may be applied, taking care not to put it too close to the entrance. The uninitiated often find it difficult to distinguish robbers from the bees belonging to the hive, and it may here be pointed out that a robber is easily recognised by the way it carries the third pair of legs while on the wing. Ordinarily, the hinder legs are not very noticeable on a bee in flight ; on a robber bee they are very conspicuous, being extended full length backwards and outwards. When robbing has only just started, the robbers may all come from one or two hives. To discover from which, put some flour in the entrance of the hive that is being robbed, and then walk round the other hives and look for returning flour-bedaubed bees. If it is only a case of one colony robbing another, changing the places of the two hives will confound the robbers and restore order.—Journal of Agriculture, Victoria.

POULTRY.

CHICKEN REARING DEMONSTRATION.

The Board of Agriculture and Fisheries have made arrangements for a demonstration to be carried out at Modern Hall, near Ashwell, with a view to showing in practice the methods of raising chickens for table purposes adopted by MR. F. G. PAYNTER. The demonstration is being conducted under MR. PAYNTER'S personal supervision and management, and forms a continuation of that conducted in 1913 at Haslington Hall, near Crewe.

A description of the object of the demonstration and of the methods adopted is given below, together with some hints for the guidance of persons wishing to make a trial of the system.

OBJECT OF THE DEMONSTRATION.

The object of the present demonstration is to give a practical illustration of the methods by which a regular supply of table chickens may be produced on a small holding, during those months of the year in which the conditions are favourable both to rearing and marketing. The raising of chickens by this method should occupy only a portion of the small holder's time, while the area of land devoted to the chickens would form only a portion of the total area of the holding. The demand for table poultry is constant, and at certain seasons of the year the supply of birds of suitable quality is meagre, so that there is little difficulty in securing satisfactory markets for a steady supply of uniform quality.

MR. PAYNTER'S aim is to raise during the season from 3,000 to 4,000 chickens weighing from $3\frac{1}{2}$ to 4 lb., and, in order to accomplish this, incubation commences at the beginning of December and continues until the end of June. The birds reach marketable size in from 12 to 16 weeks, and thus the last batch of chickens is ready for sale about the middle of October.

AREA OF LAND REQUIRED FOR CHICKEN REARING.

In order to raise 3,000 to 4,000 chickens during the period indicated it has been found necessary to utilise 4 acres of land. The land selected should be fairly light and it should not have been occupied by poultry for some considerable time previous to its use as a rearing ground. The chickens should not be raised year after year on the same ground, but arrangements should be made to change the site every year so that each plot of four acres carries poultry once in three or four years. The land occupied by the birds will receive a considerable amount of manure during the season, and advantage should be taken of this fact in planning a rotation of crops on the holding.

CAPITAL REQUIRED.

The initial capital required for raising chickens on the scale undertaken by MR. PAYNTER is from £250 to £300, and a considerable portion of this amount is devoted to the purchase of the necessary appliances. The minimum equipment required for an output of 3,000 chickens, costs £150.

LAYING OUT THE GROUND.

The method of laying out the ground and of utilising the appliances will be readily appreciated by those who visit the demonstration. A small portion of ground near the dwelling house is set aside for the reception of two or three brooders, into which the chickens are placed when they leave the incubator, and in which they remain for two weeks in order that they may be under constant observation and may be trained to run up to the hover of the brooder when they feel cold and so avoid the risk of "packing" or crowding.

The remainder of the ground is laid out for the reception of the brooders and Sussex arks into which these chickens are gradually drafted. Each brooder is placed in a run enclosed by wire netting 2 feet high supported by light stakes placed at intervals. These runs may conveniently measure 9 yards by 40 yards and are used for the chickens up to the age of seven weeks.

Each Sussex ark is placed in a run measuring 40 yards by 20 yards enclosed by wire netting 4 feet high supported by stakes. Access is gained to the larger runs by an arrangement which permits of a short length of the wire netting between two posts being swung aside. When seven weeks old, the chickens are transferred to these arks in lots of 40. The plan followed at Morden Hall is to lay out the runs for the younger chickens near the centre of the ground, while those of the older chickens are placed outside and extend to the limits of the area. Paths are provided which give access to the pens and permit of the food being conveyed to the birds with the least expenditure of labour; galvanised iron food tins containing grain and grit are placed in convenient positions near the runs. The object in selecting and arranging the appliances and in planning the runs has been to secure efficiency and economy, and to facilitate the adoption of a standardised method of management which is calculated to produce uniform results.

SUPPLY OF EGGS FOR HATCHING.

The eggs bought for hatching should be selected from breeds which are suitable for table purposes, and eggs of pure Sussex, pure Faverolles, and first crosses of these breeds may be recommended. The eggs should be the produce of hens in their second year and the pens from which the eggs are obtained should be judiciously mated. It is of the utmost importance that the breeding stock should be vigorous and healthy. The eggs used for artificial incubation should be as fresh as possible, and should preferably be not more than a week old when placed in the incubator. There are great advantages in securing a local supply of eggs, and there is likely to be a definite gain in the percentage of chickens hatched when the eggs are procured locally as compared with eggs obtained from a distance. In this connection attention may be directed to the possibility of co-operation among several poultry-keepers, some of whom might devote their attention to producing the eggs and others to rearing the chickens.

In the case of the Morden demonstration from 300 to 400 eggs for hatching are bought each week from the 1st December to the 7th June, and the approximate prices paid per dozen by Mr. Paynter are as follows:—December, *3s*; January, *2s 6d*; February, *2s. 3d*; March, *2s.*; April and May, *1s. 6d.*

INCUBATORS.

The eggs are hatched in incubators of the hot-air type, which vary in capacity from 240 to 390 eggs; at least one incubator is started each week during the hatching period. MR. PAYNTER keeps three or four incubators constantly at work and holds additional machines in reserve in case of need or accident, and to allow for the necessary cleaning and over-hauling of the machines after each hatching period.

The weekly supply of eggs is received on Saturday and the eggs are prepared for placing in the incubator next day. This is found to be a convenient arrangement, as the chickens are then taken out of the machine on a Monday morning.

The eggs are turned twice daily until the eighteenth day; on the seventh day they are tested and the infertiles are set aside for feeding the chickens in the second week.

There are several reliable makes of both hot-water and hot-air incubators on the market, and the operator is advised to follow carefully the instructions provided by the maker for working the particular machine selected.

The room in which the incubators are placed should be one in which a fairly equable temperature can be maintained, it should be free from vibration, and, while adequately ventilated, it should be free from draughts.

REARING (TOTAL PERIOD 12-16 WEEKS.)

The chickens are left in the incubator until the twenty-second day, when they are transferred to the brooders. For the first two weeks, as has already been pointed out, they remain in a portion of the rearing ground where they can be kept under constant observation. The brooders selected for use are of the hot-air type. Those used for raising chickens on the scale undertaken by MR. PAYNTER must be capable of giving satisfactory results when worked in the open under the severe conditions which prevail in the late spring. They must be simple in construction and should not demand incessant attention. The brooders used at Morden Hall are capable of accommodating 60 chickens up to the age of from 5 to 7 weeks, and hence a hatch of 120 chickens will require the use of two brooders. Two lamps are provided for each machine in order that one may be cleaned and filled while the other is in use. The brooders are cleaned out regularly once a week until the chicks are four weeks old and twice a week afterwards. Sand is used for covering the floors of the brooders.

FEEDING AND MANAGEMENT.

First Week. During the first week the birds are provided at frequent intervals with just as much food as they will clear up. The food consists of the following mixture:—

CHICK FEED.

Wheat (cracked) ...	50	per cent.
Millet	15	,, ,,
Canary seed ...	15	,, ,,
Best meat ...	10	,, ,,
Maize (cracked) ...	5	,, ,,
Rice	5	,, ,,

An unlimited supply of pure water is always provided, and grit is scattered on the floor of the brooder, and is constantly available throughout the whole process of rearing.

Second Week.—During the second week the birds are fed in the following way :—

At daybreak	...	Chick feed.
At 9 a.m.	...	Hard-boiled egg.
At 12'30 p.m.	...	Chick feed.
At 6 p.m. (or half-an-hour before sunset, according to the season)	...	Chick feed.

When the chickens are two weeks old they are moved to a brooder in the centre of the rearing field, and are confined for one day in a small wire run attached to the end of the machine. This small run is then removed, and the chickens have access to the larger run in which the brooder is placed.

Third and Fourth Weeks.—Three tins containing chick feed, and fitted with wire guards to prevent the birds scratching out the food, are placed overnight in the brooder so that the first feed may be obtained at daybreak. These tins are removed when the birds are let out of the brooder, and a tin of groats is provided for them. At 9 a.m. soft food is given, consisting of biscuit meal and 10 per cent. of meat. The biscuit meal and meat meal are mixed with boiling water and are dried off with equal parts of sifted barley meal and sharps. The mixture when prepared should be crumbly, the utmost care being taken to mix the ingredients thoroughly and to avoid the use of "sloppy" food, which is a frequent cause of trouble. At the same time any groats which have not been cleared up are removed and a tin of meat scrap is placed in the run. At 1 p.m. soft food prepared as described above is again given to the chickens, and the tin of meat scrap is removed. About 6 p.m., or earlier according to the season, the birds receive as much dry chick feed as they will eat.

When four weeks old the chickens may be divided into lots of 40, and each lot may be provided with a separate brooder and enclosed wire run.

Fifth, Sixth and Seventh Weeks.—At the beginning of the fifth week after hatching, and until they are seven weeks old, the chickens are fed as in the fourth week, but instead of the chick feed they receive a mixture consisting of :—

60 per cent. whole wheat.

40 per cent. chick feed.

When the chicks are seven weeks old they are removed to the larger runs and are housed in Sussex arks. The Sussex arks are provided with slattered floors through which the manure falls. Wooden floors are placed on the ground below the arks in order that the manure may be collected and utilised.

Eighth to Sixteenth Week.—At 7 a.m. the birds receive a mixture composed of :—

Meat meal	...	1 lb.	}
Biscuit meal	...	2 ,,	} =4½ lb.
Bran	...	1½ ,,	}

This amount is soaked in 1¼ gallons of boiling water and dried off with:—

Barley meal	...	2 lb.
Fine sharps	...	9 ,,

This ration is given to the birds again at 1 p.m. The evening feed consists of 90 per cent. of whole wheat and 10 per cent. of cracked maize.

An alternative system of feeding which has proved advantageous is as follows :—

7·0 a.m. Soft food (as described above).
10·30 a.m. A half feed of mixed grain.
1·30 p.m. A half feed of the soft food.
6·0 p.m. As much mixed grain as the birds will eat.

THE QUALITY OF FOODS USED.

The quality of the meals and grain used for feeding is a matter of considerable importance. All the feeding-stuffs should be sweet, and freshly-milled meals should be used when possible. If the feeding-stuffs are bought in quantity they should be stored in suitable bins so that they may not deteriorate. The ingredients used by MR. PAYNTER are such as can be obtained everywhere, but care should be taken in selecting them, as experience has proved that the health, and consequently the rapid growth and development of the birds, is largely dependent on the care exercised in this matter.

MARKETING.

When the birds are between 12 and 16 weeks old they weigh from 3½ lb. to 4 lb. and are sold by contract at prices varying from 3*s.* 9*d.* each in April to 2s. 6*d.* each in September. They are sent away alive in crates containing 12 birds, the purchaser paying carriage. This method has the advantages that it saves the rearer a considerable amount of trouble, and removes anxiety regarding market fluctuations, for the season's output is sold beforehand at fixed rates for the different months.

On the other hand "finished" birds, while their preparation involves additional expense in food and skilled labour, command a better market and would possibly yield a higher return. With the object of testing the possibilities in this direction arrangements have been made to trough-feed and cram a certain proportion of MR. PAYNTER'S birds during the present season, and to compare the results with those obtained by the sale of "unfinished" birds.

RESULT OF PREVIOUS DEMONSTRATION.

The result of the demonstration carried out in 1913 by MR. PAYNTER indicates that success is largely dependent on the quality and proximity of the egg supply, and that the amount of profit on the season's work is to a large extent determined by the number of birds which can be placed on the market in April, May and June.

During the season 1913 MR. PAYNTER purchased 9,897 eggs for incubation and hatched 4,028 chickens, or 41 per cent. of the total. The number of birds which reached a marketable age was 3,471, and these were sold at an

average weight of slightly over 4 lb., realising on the average 8½*d.* per lb. The cost of food amounted to £275. 7*s.* 5*d.* The net profit on the season's output, after deducting all expenses, rent, interest on capital and depreciation, amounted to £55. 1*s.* 2*d.*

It would be unwise at the outset for anyone *without* considerable experience to undertake chicken raising on the scale indicated above, but the methods adopted by MR. PAYNTER may be applied with advantage to raising a much smaller number of birds.

As experience is gained additional appliances can be purchased and the output of chickens gradually increased from year to year.—JOURN. OF THE BOARD OF AGRICULTURE.

WORMS IN GROWING CHICKENS.

During the chicken-rearing season many poultry-keepers will have observed that their chickens are troubled with intestinal worms, and, in consequence, do not thirve. They cannot understand why the chicks do not make any headway or growth. Being fed upon the best food, with good care and attention, they yet fail to grow. When chickens are making no growth, carefully examine them, and if you find the skin hard and tight to the touch, you may be sure that the trouble is worms. If such is the case it retards growth very considerably. The chicks become denuded of feathers around the head and neck, and the body feathers seem in a state of decay and drop out. This is a sure sign of internal troubles. The chickens greedily devour food, and eat more than is good for them. The food they consume cannot be assimilated properly into the system because the intestinal worms exist upon the nutriment which should build up the chicken's body. Hence, it is very important to remove the cause, and so ensure the proper development of the chick. The chief cause is undoubtedly filth, and where chickens are reared in unsanitary surroundings and are allowed access to ash and refuse heaps they will suffer from worms. Where garbage heaps accumulate from household refuse, etc., chickens should not be allowed their freedom, as some of the filthy, decaying matter is likely to enter their bodies and thus favour the presence of worms. Chickens so affected stand about dull and listless, wings hanging down, and have a dull, dejected look upon them, and "cheep" very disconsolately. To cure this malady confine the chickens, and let them fast for at least twenty-four hours. This will remove all food from the intestines. Do not withhold water, but allow them all they can drink. Give them a slight laxative medicine, such as Epsom salts—one tea-spoonful to three chickens in one pint of water, or one-quarter tea-spoonful of syrup of buckthorn per bird. The latter will be found very efficacious in expelling the worms. Afterwards stew some linseed in the oven, and mix it with the soft food. It will be found very nourishing, and will coat the intestines with mucous and so aid the digestion of the food. Hemp-seed can be given, but it is not so beneficial as linseed. Another good remedy is to soak one ounce of linseed in one pint of water for at least twelve hours, then add one tea-spoonful of tincture of iron, and give it to the chickens. Of course, whichever remedy is used, give in all cases the Epsom salts first.—FEATHERED LIFE.

SETTING THE HEN.

Whilst in South Africa incubators are the fashion, yet many farmers' wives will still use nature's way and my advice is based upon practical experience. In setting hens always try to have two ready at the same time so that at the end of the seventh day, when you test out the eggs, if possible place all of the fertile eggs from the two hens under one hen and then re-set the other hen. If upon testing the eggs, it is found that more are fertile than one hen can cover, then let both of them finish the hatch. When all the eggs are hatched, give the little chicks to the hen that you know has been the poorest sitter and give the other hen another lot of eggs. In this way you have less hens with chicks to care for. Ordinarily the two sittings of eggs will hatch from eighteen to twenty-six chicks and one hen can easily care for this many if the weather is moderately mild.

When setting a hen it is important that she could be free of lice when set on while sitting. A good plan for accomplishing this is to thoroughly dust the hen with a good lice powder before placing her on the nest; also dust her on the seventh day and on the eighteenth day. At the same time sprinkle the nest and eggs with the powder also. Test all the eggs on the seventh, fourteenth and eighteenth days and at each setting discard all eggs which do not show signs of being fertile. The reason for making these tests (for incubator work test only on the tenth day; this is sufficient) is that while an egg might show fertile on the seventh day, by the fourteenth day something may have happened to kill the young chick in the shell and it is better to get it out of the nest and make room for the ones that will hatch. On the eighteenth day make the final test. At this stage of incubation the egg will appear very dark, except on the large end, which contains the air cell. If the weather is dry and warm the chances are there is not enough moisture in the air to properly soften the shell of the egg so that the little chick can break the shell, and if this condition exists supply artificial moisture either by sprinkling the eggs with water at blood heat, or place a bucket of water near the nest. The former plan, however, is advisable.

GETTING GOOD RESULTS.

After the eighteenth day leave the hen alone and the chances are she will not leave her nest again until the eggs are all hatched. On the twentieth day the chicks will begin to cheep and it is a great temptation to lift the hen up and take a peep, but don't do it, for if you do you are apt to spoil your chances of a good hatch.

The chick first breaks the shell in one place and then by moving its head around in the egg against the inside of the shell breaks a circle around the egg and by much squirming and twisting the shell separates in the middle and the little chick rests beneath the hen, weak and exhausted.

It is important to watch the hen now. She becomes restless and there is danger that one-half of the egg just hatched will work over the end off and if this happens the chances are it will prevent the egg from hatching unless removed. When the hen starts to hatch, watch her carefully, and by putting your hand under her body, you can feel the egg shells that are there and remove them at once; also remove

the young chicks from the nest as fast as they hatch, placing them in a basket lined with cotton, and after covering, place the basket near a stove to keep the little fellows warm.

Unless this is done, many of the chicks will die in the nest, either from being stepped on by the hen or crushed between two eggs that have not yet hatched. As soon as all the eggs are hatched, take the hen from the nest, and, after giving her a thorough dusting with lice powder, place her in a coop and give her a good feed and fresh water. After she has finished eating and drinking give her the chicks.

You will notice that I have just said that I fed and watered the hen before giving her the chicks, and perhaps you will wonder why I recommend it. In the first place the hen has probably gone forty-eight hours without food and water and consequently she is very hungry and thirsty, and my experience has been that it is better to feed and water her before giving her the chicks, as she will then quieten down and give them the attention they need and not fuss around, stepping upon them and probably injuring or killing two or three at the very start.

For the first few days, or until the chicks get around lively, place the coop on a wooden platform; this keeps the chicks' feet dry and prevents the hen from scratching in the dirt and possibly burying several chicks alive. A platform for the coop is a mighty good thing to have in rainy weather, such as is experienced in the coastal regions of the Union.—South African Poultry Magazine.

CHICKENS THAT DO NOT GROW FEATHERS.

In all poultry yards the owner is greatly exasperated by chickens which seem definitely to refuse to grow feathers. These, the black sheep of the flock, soon become an eyesore, and the owner feels relieved rather than otherwise when a blazing hot sun, or a cold east wind carries them off. If left alone it is but a matter of time until this happens, and what might become a source of profit becomes a dead loss.

NEVER FIT TO BREED FROM.

Such birds are never fit to breed from, and should all be rung or in some way marked to ensure their being sent to market. The causes of this bareness are many; if rung or toe-punched it will be found that the last hatched chicks are frequently the ones which are troubled in this way. Overheating in the brooder is another cause, and the chick which meets with an accident is generally one of those which fail to thrive. Where but an odd chick or so is affected, it is far best to kill it, since a single chick will not repay for the extra attention necessary. It is at the age of five or six weeks that this lack of strength to grow feather is most apparent, and where the number will merit it, it is at that age the special treatment ought to begin.

In the first place these chicks must all be put together, since they cannot stand the amount of cold or heat the well-feathered chickens can. The most suitable building is a large warm shed, into which should be put a lamp

brooder, which should be run at a temperature of about 75 degrees. The chicks should only be given their liberty when the sun is not too strong, and yet fairly warm. Let them be caught in a shower of rain and they will soon die off.

CONFINEMENT FOR TWO WEEKS.

Provided the shed is fairly large and with a good earthen floor, it would be as well to confine the chicks for about two weeks, thus avoiding all risks, when the feathers ought to begin to grow. The food should be of a nourishing nature, and should consist of boiled maize, biscuit meal, Sussex ground oats, and a little meat occasionally. A little tonic might be given about twice a week, and milk should be given instead of water. It will be found that after two weeks of such treatment, during which time the chicks are given all they will eat, the feathers will begin to shoot, and as soon as the birds become well-feathered, they can be re-transferred.—POULTRY WORLD.

A DISEASE OF THE WATTLES OF FOWLS.

H. R. SEDDON.

The following is an account of a disease of the wattles of fowls investigated by the author at the Melbourne University Veterinary School, and proved to be due to a specific microbe which, in many respects, on bacteriological examination, behaves in a manner exactly similar to that causing fowl cholera.

The "wattle disease" appears to be a localized form of fowl cholera in which the causal microbe gains entrance into the wattles and remains there, giving rise to two very marked symptoms—(1) *enlargement*, due to the presence of inflammatory fluid, and, later (2), *distortion*, with the formation of hard nodules of cheesy material in the wattle.

Chicken cholera, it may be mentioned, presents three distinct forms. (1) In the first, the bird may be found dead, no symptoms having been observed by the poultry keeper. Such rapidly fatal cases usually occur at the beginning of an outbreak of the disease. (2) In the next type of the disease diarrhœa is the most marked symptom, and death results in from one to three days. (3) The third, or chronic, form, usually occurs in birds which have recovered from the second form, and is manifested by swelling of joints, muscular weakness, and wasting, and may extend over several weeks.

In the localized form in the wattle the microbe probably enters through wounds in that organ gained while scratching or fighting. In the cases investigated, White Leghorns were affected, but it is probable that any breed with large wattles would be liable to the complaint. For the same reason, cockerels suffer more frequently than hens. The disease was communicated experimentally to healthy birds by rubbing cultures of the microbe on wattles which had been scratched lightly with a needle.

SYMPTOMS.

The first symptom to be noticed is that one or both wattles or portions of them are much swollen, dark-red in colour, and, though hot and tender at first, soon become cold. The swelling is due to œdema, or inflammatory fluid, within the wattles, and small beads may be observed oozing from the surface. By this time birds manifest symptoms of general illness, such as ruffling of feathers, loss of appetite, and also often show an acute inflammation of the eye (usually on the same side), manifested by a gluing together of the eyelids with some discharge of yellowish pus.

Affected birds may die during the first few days of illness (acute form), but in the great majority of cases the disease becomes chronic. When the bird dies in the acute form, the microbe has passed into the blood. This may be shown by injecting a few drops of blood from a fowl just dead under the skin of another fowl, when this bird will die in from eighteen to thirty-six hours.

In the chronic form the wattle soon becomes hard and wrinkled, due to absorption of the fluid present in the acute stage. Later nodules of cheesy material form in the wattles, and there may be seen thick scabs often almost embedded in fissures of the surface. These latter mark old scars —probably those where the microbe gained entrance.

These much-crinkled wattles may remain in this condition for a considerable time, even months, and are a source of danger, inasmuch as the causal microbe may still be present in them, multiplying there and capable of spreading the disease when the scab finally falls off. Thus the bird may, apparently, recover, yet be a "carrier" of the disease. It may be mentioned here that this microbe is also capable of causing a fatal diarrhœa (like fowl cholera) in chickens.

The disease has been known to affect over fifty birds in one run, the mortality being about 5 per cent. It is not only actual deaths that are serious from a poultry-keeper's point of view, but also the great disfigurement of birds which survive—a very serious matter in pure-bred stock.

TREATMENT.

Affected birds must be at once isolated, and as soon as signs of active inflammation have disappeared, the wattles should be "cropped"—that is, removed with a sharp knife. Such an operation, of course, causes disfigurement, but the spread of the disease is checked, provided all the affected material be burned.

The fowl-house and run should not escape attention. These should be thoroughly cleaned up, droppings and rubbish should be burned, and the nests, shed, and feed or water troughs disinfected. If possible, the yard where the affected birds have been running should be dug up. In a poultry run where fifty birds were affected during one autumn, the owner, after adopting such measures, suffered no loss at all for some months, when three hens became affected. Digging up the yard where these birds had been running, and top-dressing with lime those parts where the fowls chiefly congregated, again resulted in a disappearance of the complaint.—JOURNAL OF AGRICULTURE, VICTORIA.

ENTOMOLOGY.

THREE CATERPILLAR PESTS.

DICHOMERIS IANTHES, MEYR. A PEST OF LUCERNE.

In December, 1913, Lucerne at the Experiment Station, Peradeniya, was badly attacked by the caterpillar of the Tineid moth, *Dichomeris ianthes*, Meyr. The caterpillar folds the leaflets from below upwards and eats them in patches. It is about 8 mm. long, yellowish green with the head and first thoracic segment glossy black. When viewed by the aid of a pocket lens the body tubercles are seen to be black. The pupa, which was to be found in the folded leaves, is of a yellowish colour with a brownish tinge along the dorsum. The tubercles are somewhat prominent. Moths were emerging about December 10th. The forewings are of a yellowish-brown colour with black bands and blotches and are iridescent. The hind wings are bluish-black with a fringe of long hairs. The palpi are well developed, blackish in colour, project straight forward and possess a peculiar, dorsal, hair-like projection. A few of the caterpillars had been parasitised by a small Braconid, black with the base of the abdomen dorsally and ventrally white.

CATOPSILIA CROCALE CRAMER. A PEST OF CASSIA (NODOSA ?)

In April, 1914, severa of the Cassias in the Botanic Gardens were defoliated by the caterpillars of the butterfly, *Catopsilia crocale*, Cramer ; at the height of the attack the frass in falling made so great a noise that it at once attracted the attention. The caterpillars had a habit during the heat of the day of climbing restlessly up and down the trunk and congregating between the limbs at the base of the tree, and advantage was taken of this to feed them with branches of Cassia sprayed with Arsenate of Lead. These cut branches, however, soon wilted in the strong sunlight.

Very few parasites were observed. A few Chalcids were noticed prospecting about the pupæ, and several of the caterpillars contained Dipterous puparia, but neither Chalcid nor Dipteron was reared.

A small number of the caterpillars was attacked by a disease. Such caterpillars did not manage to pupate successfully. Some hung limp having got no further towards pupation than the spinning of the girdle of silk, others had got the length of forming part of the thorax, while still others were full-formed ; but these last became of a blue-black colour and full of a bad-smelling liquid.

The surrounding bushes and trees were covered with pupæ. On the underside of one leaf of *Bryophlylum* sp. fifteen were suspended, on another fourteen. They were hanging in hundreds on the neighbouring Palmyras, chiefly on the under-surface of the uncut leaf-bases. Boys were put on to collect them.

Among the pupæ crows and king-crows did good work, though the crows in their quest of them did some damage by breaking off leaves and twigs from the more tender plants. The king-crow was also observed feeding greedily on the caterpillars

It was observed that a plant of Loranthus growing on one of the Cassias had not been touched.

In spite of all that was done a considerable emergence of butterflies took place, but that brood seems to have done little or no damage.

The caterpillar is about $1\frac{1}{8}$ inch long. The head is large and is broader than the thorax. It is of a yellow colour and bears numerous small black tubercles. The terminal segment is similar in colour to the head. The dorsum of the thorax and abdomen is of a cobalt blue colour with a more or less distinct yellowish, mid-dorsal band. The spiracles are white and are located in a yellowish band, ventrad of which runs a greenish band spotted with black. The venter is whitish yellow. There are four pairs of abdominal prolegs and an anal pair. The hooks are in three longitudinal rows. The mandibles are dark-brown at the apex and the labrum is deeply notched.

The pupa is greyish-brown to greyish-yellow. There is a narrow, mid-dorsal, blackish band, and a narrow blackish band above the spiracles, bounded ventrally by a narrow yellowish band, ventrad of which the pupa is usually paler than on the dorsum. There is distinct snout black in colour and tubercled on the dorsum, and often with a paler area at the apex.

The butterfly is the yellow and black "monsoon butterfly" which is to be seen migrating westwards about November

CATOCHRYSOPS PANDAVA HORSF. A PEST OF CYCADS.

In March, 1913, the fronds of *Cycas revoluta* in the Botanic Gardens were destroyed by the caterpillars of this butterfly, being stripped almost to the midrib. There were holes in the midrib at intervals and the inside was eaten out and the cavity full of a blackish or brownish evil smelling frass. Larvæ and pupæ were present often several in the interior of each midrib. In May, 1914, the young fronds of *Cycas Rumphii* were attacked; they elongated but were reduced to the midrib, which was dead and withered and bent and hanging limp at the apex, giving the trees a very unsightly appearance. In this case also holes had been eaten into the midrib but there was no extensive mining in the interior, probably because the food to be found externally was sufficient to enable them to complete their growth.

In the case of *C. Rumphii* the butterflies were seen ovipositing on the tender fronds. Egg-laying extended over fully a week. The eggs are pale green in colour, circular, flattened dorso-ventrally, slightly concave on the upper side and covered with a net work of whitish ridges. Many of the eggs were ruptured and I observed a minute, brownish ant actively engaged in nibbling at the eggs.

The very young caterpillars are greenish with a black head and are covered with long white hairs. They are often to be found underneath the undeveloped pinnæ of the young frond. The older caterpillars about ½ inch long, are flattened dorso-ventrally, purplish or greenish purple and spotted with white tubercles on the dorsum. The head is very small, of a shiny black or dark-brown colour and can be retracted. Some show a broad, dorsal, purplish band and a lateral, narrow, waved, purplish band; these bands coalesce at the seventh abdominal segment. There is a subspiracular row of yellow spots. The body is thickly set with short, stiff hairs each springing from a white tubercle and bearing spines at the base. On the eighth segment laterad and caudad of each spiracle is a white, reversible, finger-like body which when evaginated suggests a hydra with numerous tentacles at the end. On the dorsum of the seventh abdominal segment in the middle line is a greenish, transversely elongated area with a band of some twenty small, rounded, gland-like processes on its posterior margin. The spiracles of segments seven and eight are situated well up on the dorsum. Abdominal segments three, four, five, six, and last bear prolegs. There are three pairs of thoracic legs. The pupa is smaller than the caterpillar being about 2/5 inch long. It bears a slight hump on the thorax and there is a constriction between the thorax and the abdomen. The ventral surface as far back as the tips of the wing-cases is of a translucent olive colour. The rest of the pupa is of the same colour as the larva. Sometimes the mid-dorsal line is darker than the rest of the dorsum. The spiracles are white. The wing-cases are greenish yellow with several longitudinal dark bands. Pupæ were found in considerable numbers on the midribs well down towards the base. Several occurred on the stem of the plant below the crown of leaves. The small ants were still busy and several of the pupæ had been partly eaten. Attached to a dead larva was the white cocoon of a Braconid.

Of this insect de Nicéville is quoted by BINGHAM (F.B.I. vol. ii. p. 414) as saying: "I have never succeeded in finding the pupa on the plants and can only conclude that the ants (not the ants referred to above, but ants which attend the caterpillars for the sake of their secretion) drive the full grown larvæ down the stems of the plant into their nests where the larvæ undergo their transformations." This report refers to Calcutta, where the insect feeds on *Cycas revoluta*.

In January, 1914, the caterpillars of the same butterfly were feeding on the underside of the fronds of *Cycas revoluta*, eating through to the upper epidermis. These caterpillars were attended by ants, *Camponotus sp.*

The butterfly is one of the Blues.

An application of Arsenate of Lead at a strength of 4 lb. to 100 gallons of water made when the larvæ are young will control this pest.

A. RUTHERFORD.

SOME FURTHER NOTES ON *XYLEBORUS FORNICATUS*, EICH (SHOT-HOLE BORER OF TEA).

In the Tropical Agriculturist of February and March, 1914, I gave the results of several laboratory experiments to determine the effect produced on the contained insects when the infested prunings were buried. These experiments showed that the beetles continued to live and breed in them. While it was thought that the result under estate conditions would not be very different, it was considered advisable to obtain definite information on that point. Through the interest of Mr. D. Westland, of Tembiligalla Estate, Ulapane in the subject, I have been able to obtain such definite information and I propose in this article to give a short outline of the experiment and its results. The prunings of a field infested with Shot-hole Borer were buried on June 25th and lifted at intervals of one day, one hole being emptied each day. The prunings were forwarded to me at Peradeniya and examined at the laboratory on the following morning. Thus the first prunings examined had been buried for one day, the second for two days and so on up to twenty-nine days. Each lot probably represented a single bush or one or two neighbouring bushes ; supposing this to be so it was evident that certain bushes or groups of bushes were much more heavily infested than others. For example in one sending no tunnels at all were found. All twigs and branches were carefully examined and every tunnel whose entrance was open was followed to its farthest ramifications. In the course of the examination many tunnels were found to be occluded. As this occlusion must of necessity have taken place prior to the burying of the prunings such galleries were neglected from the point of view of the experiment. It may be noted, however, that in very few cases were any insect remains found in such galleries, save rarely a ruptured, dipterous puparium. In practically all cases the beetles had escaped before the disaster had overtaken them. Such occlusion is doubtless a manifestation of the vigorous growth produced by cultivation and fertilising. In the empty open galleries no remains of insects were found, as one should have expected, if insects had died in the galleries ; for no animals which might act as scavengers were observed, except at rare intervals, a few mites.

Dipterous larvæ and puparia were not uncommon and were found, as on previous occasions, associated with living adults and larvæ and eggs of the beetle. It is worthy of note that adult flies emerged from puparia that had been buried for several days. It was observed on many occasions that termites had chosen the opening of a tunnel or a pruned surface, which had passed through a system of galleries, as a point at which to begin their depredations, and from these points tunnels often descended far into the branches. Might not just such a tunnel form the starting point of a Calotermes colony ? This fact at any rate suggests that, if war were waged on termites in the plantations, a decided improvement in the condition of the tea might with confidence be expected.

Before setting forth the results of the experiment the following details kindly supplied by MR. WESTLAND may be given. The tea is Manipuri indigenous and had run 23 months from the previous pruning. It is shaded with dadap regularly pollarded. It had received a regular bi-annual application of a well-balanced mixture of artificial manure, applied between 3 to 5 months after pruning. Basic slag and potash or lime were applied previous to pruning. The yield from the field of 32 acres for 1913 was 1164 lb. per acre. Shot-hole Borer was active and had been on the tea for many years. The prunings were buried immediately after the pruning, in dry weather. The type of burying was good, average work. Basic slag and potash were applied in the usual quantities along with the prunings.

The rainfall in inches during the period of the experiment was distributed as follows beginning with that of June 25th and ending with that of July 24th :— 0; ·53; ·58; 0; ·31; ·71; ·61; ·76; 0; 0; ·37; 0; ·70; 0; ·35; ·22; ·45; ·35; ·28; ·25; ·48; 0; 0; 0; 0; 0; ·17; ·42; ·15;—Total 7·69 inches.

But one or two records from each day's examination have been included. It will be observed that adults, larvæ and eggs were present even after an interval of 29 days.

In view of these facts is it to be wondered at that the insect has not only held its own but has continued to increase and spread throughout all these years ?

No. of days buried.	No. of empty galleries.	ADULT		PUPÆ		Larvæ	Eggs
		Female	Male	Female	Male		
2	4	1	1	0	0	4	0
3	4	2	0	1	0	3	0
		1	0	0	0	5	1
4	8	1	0	1	1	3	0
		0	0	0	0	5	2
		1	0	3	1	4	0
		2 dead	0	0	0	0	0
5	6	1 dead	0	0	0	0	0
		1	0	0	0	3	4
		2	0	1	0	3	0
6	3	1 dead	0	0	0	0	0
		2	2	0	0	0	0
7	7	3	0	0	0	0	0
8	12	0	0	0	0	1 dead	0
		6	1	1	0	8	0
		1	0	1	0	6	2
9	8	1	0	0	0	0	0
		1	0	0	0	6	2
10	2	2 (1 dead)	0	2	1	0	1
		2 (1 dead)	0	0	0	4 (2 dead)	0
		2	1	0	0	4	1
		4	3	1	0	4	0
11	11	*2 dead	1 dead	2 dead	3 dead	0	0
		2	1	0	0	2	0
		1	0	1	0	2	0

*Tunnel full of water

No. of days buried.	No. of empty galleries.	ADULT		PUPÆ		Larvæ	Eggs
		Female	Male	Female	Male		
12	7	8	0	1	0	3	0
13	8	2 dead	0	0	0	0	0
		1	2 (1 dead)	0	1	3	4
		1	0	2	0	2	1
14	5	4 (2 dead)	0	0	0	1	1
		1	0	0	0	0	5
		1	1	0	0	3	0
15	12	2 dead	0	0	0	0	0
		2	1	1	1	3	0
		1 dead	0	0	0	0	4
		1	0	0	0	6	0
16	5	1 dead	0	1	0	0	0
		2	1	1	1	3	0
		1	0	0	0	4	1
		1	0	1	1	1	0
17	5	1 dead	0	0	0	0	0
		1	0	0	0	5	0
		3	1	0	0	0	0
18	7	1 dead	0	0	0	2	2
		1	0	0	1	6	0
		1	0	0	1	2	2
19	8	1 dead	0	0	0	0	0
		1	0	0	0	0	0
20	4	2 (1 dead)	0	0	0	0	0
		1	1	0	0	4	0
21	8	2	1	0	0	5	1
22	3	2 (1 dead)	1	0	0	0	0
		1	0	0	0	3	2
		3	1	0	0	0	0
23	0	3	1	0	0	0	0
24	3	1 dead	0	0	0	0	0
26	4	0	0	0	0	3	1
27	8	1 dead	0	0	0	0	0
		0	0	0	0	3	0
28	6	1 dead	0	0	0	0	0
		1	0	1	1	1	1
29	8	4	1	0	0	0	0
		2	1	0	0	0	2
		1	0	0	0	2	0
		2	1	0	0	0	1
		1	1	0	0	1	0

On June 23rd at Ulapane I examined some prunings that had been buried since May 22nd with basic slag at the rate of 200 lb. to the acre. The soil was fairly heavy and the prunings were well covered with earth, only an end of a twig protruding here and there. The rainfall for the period was 13·30 inches. The prunings were in most cases well decayed, and not infrequently the galleries were standing full of water. We opened a number of galleries and found several dead beetles but never more than one in a tunnel. And in one gallery we found a female and two larvæ alive and vigorous !

One of the features of Shot-hole Borer attack that is much complained of is the loss of branches that, having been girdled by the insect, break over. I have observed that, at least in the neighbourhood of Peradeniya, such broken branches are chiefly located on the outside of the bush and the breakage is doubtless due in chief part to pluckers crushing between the closely-planted bushes or reaching over to pluck the side of the bush opposite to that on which they are standing.

A. RUTHERFORD.

ENGLISH SCIENCE AND AGRICULTURE.

In a recent issue of the *Tropical Life*, published in London under the caption of "A Spendthrift's Budget," the editor criticises the English government for taxing the people the equivalent of about a thousand millions of dollars without including in this enormous budget a satisfactory appropriation for the development of education in tropical medicine and tropical agriculture. Two tropical agricultural colleges have been asked for, one in the East, perhaps in Ceylon, and one in the West, perhaps at Trinidad, British West Indies, but nothing thus far has been done.

The development of tropical industries along modern lines practically began in Louisiana some twenty-five years ago, when Dr. W. C STUBBS started the Louisiana Sugar Experiment Station under the auspices of the Louisiana Sugar Planters' Association. The Far East, or at least Ceylon, has been urging an allotment of $2\frac{1}{2}$ million dollars for the foundation of a tropical school in that famed island, where a high order of learning has been in vogue for more than a thousand years. It is now proposed to concentrate the intelligence of the country in industrial research work under the conditions that prevail in the tropics. The vast capacity of the tropics for production of food stuffs, cotton and fibres generally, has obscured the necessity for a high order of teaching these arts.

The success of our Louisiana Sugar Experiment Station and the enlargement of the work in Louisiana to cover all of the leading products of the state while preceded by the famous experiments of LAWES and GILBERT at Rothamsted, England, made Louisiana the starting point for tropical research and experimental work, and we find that even the Japanese are working up to the very highest standards, and that the British East Indian government is carrying on excellent research work at its various stations throughout the Indian Empire and so on throughout the whole tropical world. While nature is bountiful in the profusion of its productions, yet the producers must be taught how to get the highest degree of effectiveness with the least expenditure of human labour and at the least total cost for labour. The progress made in the last thirty years has simply been marvellous and the efforts now making to induce the English government to take hold of the problems, including tropical medicine as one of the essentials, would seem to be a move in exactly the right direction, and the editor of TROPICAL LIFE deserves much credit for his continued insistence on more consideration by the British government of these projects.—LOUISIANA PLANTER.

CO-OPERATIVE CREDIT MOVEMENT.

A BANKER'S REPORT ON CO-OPERATIVE CREDIT.

The Central Provinces Administration last year took the interesting step of inviting the Allahabad Bank to send a representative to investigate the working of the co-operative system in the Central Provinces and Berar. It was evidently felt by the Provincial authorities that, as the assistance of the Bank was likely to be required in increasing measure in future years, the directors should be given an opportunity of satisfying themselves regarding the financial soundness of the rural co-operative societies, the central co-operative banks, and co-operative organization as a whole. The Allahabad Bank accordingly deputed MR. W. RENWICK to make the necessary inquiries, and the results of his inspection have been published in a readable and informing report. The investigation was of special importance since it was the first scrutiny of co-operative credit institutions in this country made by an independent observer. Official reports we have had in plenty, but the ordinary reader is prone to cherish the suspicion that an official chronicler puts the best face possible upon Government enterprises, so that institutions which are in reality lifeless and artificial are apt to be described as if they served some useful purpose. Anyone acquainted with the broad facts would, of course, be aware that the co-operative credit societies, which employ a capital of 534 lakhs and receive only 11 lakhs in State aid, cannot be pious frauds. But the comparative indifference with which co-operative credit is still regarded shows that its value is even now imperfectly grasped, and it may be hoped that the publication of the results of a survey carried out by a banker will do much to convince even the sceptical that co-operative credit is a great fact. MR. RENWICK does not conceal his sense of the difficulties with which this beneficent institution has to contend in the Central Provinces. The general lack of education is a terrible handicap. Only 33 persons out of a thousand can read, and, unhappily, such primary education as is given does not much improve the situation since so many of those who go to the primary schools lapse into illiteracy when their brief schooling is over. "My tour in the Central Provinces and Berar," he writes, "convinces me that the cultivating classes and the people engaged in cottage industries are extraordinarily backward, prejudiced, and, almost beyond belief, illiterate." Not only are the people ignorant, but they have lost, if they ever possessed it, the instinct of co-operation. At the same time the old machinery by which agriculture was financed is, in MR. RENWICK'S opinion, "sadly out of gear." A new system is required to cope with a problem whose magnitude may be inferred from SIR REGINALD CRADDOCK'S calculation that "a capital of at least ten crores of

rupees could easily be sunk in financing the cultivators of these provinces." Apparently the only safe solution of the difficulty is to be found in a vast network of co-operative credit societies, and when it is remembered that, since the establishment of a few experimental societies in the Central Provinces ten years ago, the capital which co-operative credit has acquired and is utilising is nearly 35 lakhs there is some ground for the belief that co-operative societies, if they are wisely managed, will ultimately become the people's banks, controlled and to a large extent financed by the people. The question, therefore, whether the co-operative system is well organised is one of profound importance. MR. RENWICK, after thoroughly examining the central banks and after inspecting in detail the affairs of 250 rural societies, is satisfied that the task which seemed insuperable has been accomplished and that in spite of all difficulties the Central Provinces have been "well equipped with first class co-operative machinery specially designed for their peculiar needs." It is clear, however, that the practical success of the movement depends not only on a good system, but on the ability and readiness of all concerned to discharge their respective duties. Thus in a village society, which borrows money on the strength of the unlimited liability of its members, solvency can be maintained only if the members deal faithfully with applications from their fellow members for loans. If they grant loans heedlessly, the society will come to grief. MR. RENWICK, it is pleasing to find, regards the control exercised by rural financiers as real and effectual. "Actual inspection of the working of societies," he states, "makes it quite clear that if A is going to be responsible for B, he will not consent to allow B to obtain an advance of money beyond his means and beyond his powers of employing it to good advantage." Nevertheless MR. RENWICK affirms very emphatically that there ought to be no withdrawal of Government assistance "for an indefinite period of years to come," and he enlarges upon the necessity of gradually educating the people in the practice of co-operation. The inference seems to be that, in the Central Provinces at any rate, the successful working of rural co-operative credit societies is ensured by the strict supervision and sympathetic advice of the Registrar and his officers. In the case of the central banks and of the Provincial Bank the independence of the voluntary workers upon official help is evident. "It is clear to me," says MR. RENWICK, "that the directors of central banks look on the Registrar as their leader and that they seek and obey his instructions with regard to the working of their banks." The necessity of skilled guidance in the management of banking business can be readily appreciated, and, as MR. RENWICK points out, in Europe the co-operative movements have progressed under autocratic leaders. We cannot be surprised, therefore, if in backward provinces where illiteracy largely predominates, and where co-operative credit is still a plant of tender growth, official leading and nursing are indispensable. There are, however, indications that the spirit of co-operation is entering into the societies and banks, and their vitality is none the less genuine because at present members and directors are prepared to follow disinterested advice.—INDIAN AGRICULTURIST.

CO-OPERATIVE CREDIT IN THE UNITED PROVINCES.

Mr. S. H. Fremantle of the Indian Civil Service, who is also the Registrar of the Societies in the United Provinces, is the author of the 4th edition of an interesting pamphlet dealing with Co-operative Credit Societies in the United Provinces. We take the following excerpts from it :—

There are two main types of societies at work in these provinces. The first main type of society is that called after Raiffeisen. In it there are no (or merely nominal) shares and, unless it has wealthy members ready to make deposits, it is financed entirely by borrowed capital. Such societies distribute no profits, and all profits go to the reserve, which is used to increase the working capital of the bank and to provide a sinking fund for repayment of debt and ultimately to reduce the rate of interest on loans.

The second type, which may be called after its founder Luzzatti, is one in which each member takes up at least one share which must be of small amount and can if necessary be paid up by small yearly, half-yearly, or monthly instalments. Such a society distributes profits as soon as a share is fully paid up, but the rate of dividend is carefully limited by the by-laws so that the main object of the society—the provision of cheap credit—may not be lost sight of.

SOCIETIES WITHOUT SHARE CAPITAL.

Such societies named after their founder Raiffeisen were formed originally in Germany for the benefit of the poorer classes of cultivators and artisans who were held to be too poor to subscribe for shares. Subsequently in order to comply with the law shares were introduced, but they were always of very small amount. These societies were associations formed to borrow all the funds required on the joint security of their members at a fair rate of interest and to advance loans to their members at a slightly higher rate, the balance being the profit of the bank.

The original societies formed in these provinces were of this type. There were no shares and the society depended entirely on funds received from outside. No sacrifice except a 4-anna fee was required from the members. In many places the movement was met with suspicion and persons could, with difficulty, be induced to become members and take out loans. When loans were taken out the borrowers regarded the society as the property of some benevolent outsider : if the organiser was an influential and energetic person he realised the loans, otherwise they were left to run on. In any case the borrowers did not regard themselves as in any way interested in the success of the society. When the act was passed and the condition of these societies came under review, my predecessor was struck with the lack of interest taken by members in the affairs of their society, and in that view introduced a system by which all the members agreed to deposit a small sum each harvest according to their means or the amount of their loans. This had to some extent the desired effect. The members can afford to deposit, for the amount is always less than they save in interest, while their willingness to do so shows that they now appreciate the benefits they receive from the bank. But the system is not wholly satisfactory

because a man can withdraw his total deposits, while still remaining a member, and so lose his interest in the society, while in addition the record of large numbers of petty deposits and the calculation of interest on them and payment of the same, or its addition to the capital, adds much to the account work. To remedy these defects it was determined to introduce wherever possible societies with share capital.

SOCIETIES WITH SHARE CAPITAL FOR AGRICULTURISTS.

The form of society which has been found most suitable for agriculturists is that originally introduced in the Punjab, which was based on the Luzzati system in force in Italy. In this form of society shares are in these provinces fixed at Rs. 10 or Rs. 20 per plough to be paid up gradually by half-yearly instalments of annas 8 or Re. 1 respectively. The half-yearly payments have been fixed at as small a sum as possible, in order that no cultivator should be debarred by poverty from joining the society. Each member must take as many shares as he has ploughs. The society pays no interest on instalments of share money, but after ten years, when the shares are fully paid up, a dividend (limited to 10 per cent.) will be distributed if profits admit. The advantages of this system are several :—

Firstly.—Each member becomes a shareholder or *hisadar* in the society and so comes to understand that he is really interested in the success of the concern.

Secondly.—Accounts are simplified, there being no fraction of a rupee to record except 8 annas and no interest to calculate.

Thirdly.—The capital will rise quickly because compound interest will be mounting up on the instalments paid towards shares. (Thus supposing 50 shares of Rs. 20 payable by half-yearly instalments of one rupee, and supposing the average rate of interest gained to be 10 per cent., in 10 years the society will have a capital of over Rs. 1,600.)

Fourthly.—Profits being payable and not interest the objections expressed by a certain section of Musalmans who decline to take interest disappear.

New societies among agriculturists in these provinces are almost all being formed on this system.

SOCIETIES WITH SHARE CAPITAL FOR ARTISANS.

Similar principles are being applied to the formation of share capital societies for artisans. The shares may be of Rs. 9, Rs. 10, Rs. 20, or Rs. 50 value and instalments may be paid up by monthly instalments of anna 1, annas 2, or annas 4, so that the poorest person may not be debarred from joining the societies. Successful societies on this model have been formed among the following classes : fruit sellers, vegetable sellers, brass workers, hand-loom weavers, furniture makers, tanners, shoe makers, *ekka* drivers, etc. It is found that the members of these societies fully appreciate the advantages they derive from them and they are careful to repay their loans and pay their instalments towards shares at the proper time.

LIMITED OR UNLIMITED LIABILITY.

In rural societies whether they are based on share capital or not liability must be unlimited ; and this is right, for the members in properly constituted societies whose sphere of action is not too wide, all know each other and the spirit of joint responsibility is strong. This is also the case in small urban societies composed of men engaged in the same trade or occupation. The members here also readily accept the principle of unlimited liability. Our experience here is in accordance with that of Germany, where in the great majority of credit societies liability is unlimited. In such urban societies, however, as are composed of men of different occupations and different stations in life it is better that the liability should be limited to the actual value of the shares, so that the richer members may take up more than one share, thus increasing the funds of the society and giving them larger interest in its success.

SO-CALLED NEW PRODUCTS.

It is a common experience to read of new products (grains, vegetables and fruits) which on close acquaintance turn out to be old friends in a new guise.

For instance, the American cow-pea (*Vigna sinensis*) is only a variety of our local Me' or long bean ; the Australian Asparagus pea (*Psophocarpus tetagonolobus*) is identical with the Princess or four-winged bean. Not long ago there were some startling statements concerning a gigantic bean which was boomed in the press by an Australian correspondent, and ultimately turned out to be our homely snake-gourd (*Trichosanthies anguina*) ; and quite recently the same correspondent has written about another new vegetable (the Desheen) which like the Taro of the West Indies is a species of the edible *Golocasia*) we know as Rata habarala, dehiala, kiriala, etc.

The fra-fra potato introduced from the Gold Coast is practically the same as the local innala (*Plectranthus tuberosus*). Among fruits we find similar cases, e.g., the Grape fruit of America is a variety of the Pumelo (*Citrus decumana*). Recently reference was made to a new cereal (*Pennisetum typhoideum* as a substitute for rice. This is an Indian millet cultivated by Tamils in Ceylon, and commonly known as Kambu or Bulrush millet. As to its being a substitute for rice, so is Indian corn, sorghum, kurakkan, mineri and other so-called dry grain crops, among which Kambu is certainly not the best. The re-introduction of plantains (bananas) from Queensland and Fiji have only given cause for disappointment, for we have excellent varieties in Ceylon, though for market purposes it is only the inferior heavy-bearing kinds that are most largely cultivated.

Again when it comes to oranges what could be better than the luscious fruit to be found in Cotta, Kesbewe, Akmimana and other places known to a comparatively few, or the "loose-jackets" (mandarins), equal to the best "Nagpurs," so rarely met with. As regards mangoes, though the sugary varieties of India are so highly esteemed there, our best local varieties, if one knows where to get them, cannot be surpassed for richness of flavour.

The fact is that we do not sufficiently appreciate what we have got, and do not make the best of our local products. We should rather try to propagate our best varieties of fruit and vegetables, and improve the strains we have, than look out for new kinds which frequently turn out a disappointment.

C. D.

GENERAL.

THE CEYLON PEASANTRY.

BY R. CHELVADURAI-PROCTOR.

(*Contd. from p. 174.*)

An examination of the system known in Sinhalese as *Ande* and in Tamil as *Varam* or *Varakuddi* will repay the trouble. The system is an ancient one, which defines the relations of capital to labour, and vice versa. Under it, labour becomes associated with capital in partnership, and shares in the profits of their associated business. Till the profits are realised, it becomes the duty of capital to maintain labour with provisions, cloths, cash, etc. In paddy cultivation, invariably this is the system which is followed. In other industries also, such as fishing, mining for precious stones, cattle rearing, etc., the same system obtains.

The excellence of the system needs no recommendation. It has tended to the promotion of peace, civic unity, and diffusion of wealth. The interests of capital and labour being united, there is no element of cleavage between the two, and the result has been uplifting. The land owner who employs on this system cannot be an idle partner. He must earn his share by rendering some service. The contribution of directive intelligence to the industry must come from him. All along the land owners have acted on the principle laid down by the Tamil poet about 1800 years ago:

When master from the field aloof hath stood
The land will sulk, like wife in angry mood.

(DR. POPE'S translation of Kurral).

The system of paying "wages" in shares of the produce has the advantage of the sliding scale. Once the proportion of shares has been fixed on the basis of reasonable reward to labour or fair wage, the necessity to revise the rates will not occur for a long time—for the price of the staple food of the people ordinarily measures other prices; and fluctuations of the market will not affect the ability of the peasant to live on his "wages."

But if the peasant will unduly raise his own standard of living, consuming largely goods produced in countries not governed by "rice economy," only then will his equilibrium come to be disturbed. The community at large will come to suffer through the resulting enhanced cost of production of the staple article of food. But in this matter the proverbial "conservatism of the peasantry" can well be depended upon. If the peasant has refused to adopt the higher standard of living so much in evidence now-a-days among the educated classes, it is because the instinct of self-preservation is strong in him. He fancies he belongs to the order of social service to whom some luxuries must be denied, even as they are to the priesthood. The poet said:—

"They nothing ask from others, but to askers give
Who raise with their own hands, the food on which they live."

(DR. POPE'S translation from Kurral).

And this is the position that the peasant has maintained for ages. Dynasties rose and fell, rulers have come and gone, but *he* lives, and lives in the quickened consciousness of the fate that overtook those who overlived

absorbing into their own interest the interests of other people and monopolising the luxuries of the country. *He* has survived them all by under-living them.

To resume. Let us examine some details of the scheme of partnership of labour in rice production.

Batticaloa offers a good field for research as it is, in matters agricultural, like a buffer state between Sinhalese and Tamil districts. Here cultivation is on a large scale and customs connected with it are comparatively primitive. The landlord, known there as *Podi*, gives over, say, thirty acres of paddy land to a body of cultivators the head of whom is known as *Mullaikaran* and the rest as *Veliyans*. The conditions are that the produce of 1/5 of the sown extent is set apart as the share of the landlord. This extent is known as *Mutteiu* (literally the front tract) which is usually the best portion in the whole tract. The entire produce of this portion is given over to the landlord in lieu of rent. The head cultivator, *Mullaikaran*, gets the produce of 1/6 of the sown extent. His position is that of the intermediary between the landlord and the *Velians*, organising labour and directing operations. His share is known as *Elavisam*—a term which in Jaffna is used in a contemptuous sense to denote "unearned increment." The giving of this share—*Elavisam*—seems to have been long discontinued there, while the word apparently echoes the bitterness of the struggle that must have raged over the appropriation of this share. The produce of the remaining 19/30ths portion (roughly) of the sown extent goes as "wages" to Velians. A small extent will also be cultivated for the benefit of the watcher, known as *Kuruvikaran* (literally the man who keeps away birds). The straw realised from the *Mutteiu* is given over to the landlord—*Podi*—while that of the remaining portion go to the *Velians*. During the season of cultivation, the cultivators and *Mullekaran* receive from *Podi* each 3 avanams paddy (22½ bushels) for consumption.

From the 19/30th share of Veliyans are deducted the seed paddy, the charge of hire of buffaloes for ploughing and treading and all other sundry expenses such as paddy required in connection with a ceremony at the threshing floor, present to *podi* known as *podi puthar*, etc.

Expenses of cultivation of 30 acres are as follows:—		
Seed paddy		112½ bushels
Hire of buffaloes at the rate of 10 bushels for ploughing 5 acres ...		60
Hire for treading and threshing ...		10
Sundry expenses, roughly ...		112
	Total	294½

If the yield be 10-fold which may fairly be taken as the average in the extensive method followed there, the total output will be 1125 bushels; and 19/30ths of which will be 712 bushels. Deducting expenses shown above the Veliyans' nett share will be 417½ bushels; this may be taken to represent "wages" of 6 Veliyans, each getting 69 bushels in addition to their respective shares in straw. Assuming that *Veliyans* worked 7 months in the field (usually they have 3 months' rest, the period intervening between sowing and reaping) the income cannot be deemed as unsatisfactory. Usually a family sends more than one *Veliyan* to the field and the joint earnings go to the same family. The ceremony connected with the threshing of paddy is simple. Plantains, betel, arecanuts and some arrack are brought to the threshing floor and "poojah" ceremony is performed before work is begun invoking the guardian deity's blessings. After the ceremony is over the drink, fruit, betel, etc., are buried near the threshing floor and are dug out

again after all the work connected with the field is over. This day is celebrated by the landlord who feeds the *Veliyans*, at his own expense, on a large scale and the arrack is consumed with great conviviality. The feast settles differences if there had been any, and both capital and labour leave the field with feelings of esteem and regard for each other.

When cultivation is undertaken on a large scale, labour combining to carry out the work, the expenses and shares are as stated above. But in the case of a single person working alone, the custom seems to be modified. He can cultivate only two acres and during harvesting time he must engage extra labour. Usually the hire demanded during the season is high and he pays the penalty for his inability to combine. But there is this counterbalancing advantage: his yield is usually more than what combined labour on a large scale of cultivation secures on equal extent of ground. On the two acres (one avanam) the average output may be fairly taken to be $97\frac{1}{2}$ bushels (13 fold). His crop is subject to the following charges which explain the position of the individual cultivator:—

	Bushels.	Measures.
Seed paddy	7	16
Hire for cattle	7	16
Paddy advanced for consumption ...	7	16
Paddy to meet water rate	15	00
Reaping hire	3	24
Hire for binding into sheaves and for conveyance to place of threshing ...	3	24
Vadda Vidane's & Adicary's Share ...		16
Present to *Podi* known as Podi Puthar ...	1	00
Transport hire	2	16
Hire for levelling plank		16
Paddy required for the ceremony at the threshing floor		8
Paddy for feeding the man engaged in threshing	1	00
Paddy required to meet the hire for treading and threshing buffaloes	1	00
Hire for watcher		24
Sundry other expenses: charity, etc. ...	2	16
Total bushels ...	55	00

Balance ($92\frac{1}{2}$—55)=$37\frac{1}{2}$ bushels is divided equally between the landlord (podi) and the cultivator each getting $18\frac{3}{4}$ bushels paddy and shares with straw.

If the cultivator be his own landlord, and the ploughing cattle his, the expenses would be considerably reduced and his gain considerably increased.

In Jaffna the system is worked on simple lines. Precarious as is paddy cultivation in Jaffna depending on timely fall of rain, the *Varakaran* (cultivator) must have some assurance of his "wages," and he gets the entire outturn of straw which is valuable there. Even when harvest failed he could depend upon it. The paddy is divided into 4 shares, *Varakaran* getting one and the landlord three. A quantity known as *Kanthu Kalam* representing, roughly, 5 to 8 per cent. on the gross outturn is left out without measuring, and this is distributed to the "servants" of the village after all the work is over. Here the yield, season favouring, is 25 to 40 fold.

In Giruwa Pattu West, the following system of division obtains:—(1) One-tenth of the gross produce, which formerly went to Crown goes to *Paraveni* owner (landlord); (2) Seed paddy used, at the rate of $1\frac{1}{2}$ to 1, is taken out from the gross produce for the lender who is usually the Manager

commonly known as *Gambara Karaya*. He is also bound to make advances to cultivators as necessities arise of any nature and recovers such advances at the rate of $1\frac{1}{2}$ to 1 at harvest.

My friend who supplies me with the information regarding the district argues that "this interest of 50 per cent., as they call it, looks to be on the face of it as exorbitant; but it is not so, when the facts are carefully seen. At the time of lending, market value of paddy is high. At the time of recovery, it is at the lowest. So the paddy owner could have sold at high price and bought at low price at harvest time. The 'Manager' has to supply the wants of the cultivators with no security other than his share of the crop to be got on the field, with the attendant risk, in the event of failure of crop, of having to finance the same set of men for the same field at next cultivation to recover his debts."

(3) 1/7 of the gross income goes as share due for reaping, stalking and threshing.

(4) *Ken* and *Necket*—a small quantity to the villiage *Beruvava* (weather prophet and scientist?)

(5) A small quantity to barber.

(6) Charity. The "Manager" collects a small quantity to be spent on the village Pansala.

(7) *Alut bat* share due to cultivators. A small quantity to be cooked and partaken of by male members of cultivators' families and of neighbours on the threshing floor. No fish or meat is admissible. *Hal kiri* (a gruel made of rice flour, honey or sugar, and coconut milk) is indispensable.

(8) *Huwandiram* (Headman's share) 10 kurunies on every avanam (about 9 per cent.).

(9) Balance is divided into four equal shares and one goes to the landlord in addition to 1/10 gross above referred to.

The remaining $\frac{3}{4}$ is again divided into 5 equal shares of which 2 shares go as hire for cattle and the remaining 3 shares to the cultivators. Here the yield is 12 fold.

The *Ande* system is so popular in this, as in many other districts, that it is considered by the agricultural classes to be derogatory to work for money wages. In the *Ande* system, it is argued, "wages" come directly from mother-earth, while in the other man sells his knowledge and his muscles to a fellow-being and binds himself like a hireling. This is repulsive to the sense of honour of the agricultural caste. So strong is this sense in this district, that in one of his administration reports, the Assistant Government Agent observes that "villagers preferred to starve rather than leave their village to do work they were not accustomed to." In some districts this prejudice is being overcome, even there men prefer to be put on piece work, "*Contratu Veda*" as they call it, rather than enlist themselves as coolies.

In the Chilaw district, under the village tanks the division of crops is as follows:—

(1) If artificial manure has been used the price is paid from the gross produce, a bushel of paddy going for Rs 1/- to Rs 1·33, according to previous agreement. The balance is then divided into 10 equal shares, leaving out a quantity varying from 5 to 6 per cent. on the produce out of account for distribution among the poor "servants" of the village. Of these 10 shares

two (i. e. 1/5 of the produce) go to the landlord. Two (i. e. 1/5 of the produce) are given to the cattle owner. Two are given in repayment of seed paddy.

Four shares (i. e. 2/5 of the produce) go to the cultivators.

The straw is divided equally between the landlord and the cultivators. The lender of the seed paddy, who is usually the landlord, must contribute labour or pay for reaping half the harvest.

All expenses connected with paddy ceremonies should be borne equally by the landlord and the cultivators. Here the yield varies from 15 to 40 fold.

The Wanni system of "*Varakudi*" was investigated in 1842 by Mr. Dyke, the then Government Agent, Northern Province. The results he embodied in his diary. He wrote "*Varakuddis* (Metayers) have sometimes cattle of their own. They do not cultivate grain on their own account; it would be incompatible with their obligation as *Varakuddis*. They lend their ploughing buffaloes to others and keep milch cows. Their cattle are sometimes employed in the cultivation of their master on payment by him for the use of them in the same manner as would be done to another person. Many families have become farmers themselves, having by industry obtained the means of acquiring and cultivating land. They sometimes purchase lands of their own masters. The *Varakuddis* are not of any particular castes. They marry into the families of their masters sometimes, when their debts are generally cancelled." (See Monthly Literary Register Vol. II page 26).

This contribution having become lengthy, I stop here in the hope of resuming the subject in the next issue. I acknowledge my indebtedness to my friend Mr. A. Sanmugam, retired Head Clerk, P. W. D., Batticaloa, for furnishing me with a comprehensive account of the conditions of cultivation in the Batticaloa district which has been of great use to me.

NOTE BY THE EDITOR.

We print Mr. Chelvadurai-Proctor's paper as one of the greatest interest, but confess at the same time to a lack of appreciation of the system described. In actual working, we believe, these practices approach nearer to a "Truck System" than to any system of profit sharing. "Truck Systems" have met with universal condemnation, and in general have been made illegal in Western Countries.

One particular drawback of the method from the agricultural point of view is that the actual cultivator has no choice in the matter of seed, but must continue to plant the deteriorated produce of previous years. No progress is possible while this practice continues. It approaches the practice of the moneylender-cum-seedsman who flourishes at the cost of the small British farmer, and after lending him money forces him to take any kind of seed.

While we welcome such accounts as the present, which throw valuable light on the economic side of paddy cultivation, we would urge that descriptions of paddy cultivation in various districts from an agricultural point of view, each describing exactly the methods followed in a single district, would be even more valuable. Might not one of the Associations interested in paddy offer the usual reward for the best account of the agricultural operations of paddy cultivation, such account to be confined to the actual practice of one district, the choice of which to be left to the competitor?

T. P.

WHITE ANTS.

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STREET TREES.

Street trees have furnished the topic of much discussion in California, where we never lose an opportunity to expound the subject. They form, as it were, a bone of contention which we can never gnaw and pick and which seems never to lose the savour that bones of contention are wont to hold. The daily papers continually confront us with appeals for more street trees; we read about their charm and beauty in the Sunday Magazine sections; we are enlightened as to their desirability and aid in the healthfulness of a community, in all the farm and horticultural periodicals of the State; and then we go to the meetings of the various horticultural societies and civic leagues to learn why we should plant more street trees. We revel in the lore and fondly picture our home city as it will be a generation, or even fewer years hence, when it shall have become a veritable bower of verdure through our far sighted planting and tender care of its street trees. It has ever been so.

Every home plants trees in front of its sidewalk. Every small town fills its street parkways with trees concerning which it passes many laws and goes to much expense. They are rather costly to buy; require considerable labour for proper planting; must be nurtured during their youth, lest they die of thirst and neglect; must be pruned, as all young things, to influence their direction of growth and curb their natural desires that seem misdirected. But when we have once established them, they afford such delightful places for the small boy to carve his initials while trying out his new knife, and make such

lovely fodder for the old family horse that chews them between naps that he takes while waiting at the curb, that we immediately consider their removal thinking they serve the community too practicably. But why should it be that no sooner do such civic improvements become established than we decide that they are in the way of future development of our little metropolis and so must give way to sidewalks and stone gutters? Why do we plant such things and cut them down, and still continue to gnaw the bone of contention?

Now we all appreciate the beauty of street trees, both in the city and the country, enjoying all the while the cool shade that they furnish from the burning rays of our subtropical sun. If we stop to consider, we cannot but remember that they tend to temper the dry heat of our summers by the vast amount of evaporated moisture that they daily transpire from their leaves; that they break the sweep of our trade and storm winds, stopping and holding the while much of the atmospheric dust; and that they consume the poisonous carbon dioxide gas, exhaling in its stead pure oxygen. We love their grace and charm as we fondly recall some well planted avenue that remains ever fresh in our memories. But we forget all of this as soon as we see a tree standing where we might put in a concrete sidewalk, were the money available. It never occurs to us to save the trees, as other countries have been doing for generations, by leaving sufficient space around them for watering and cultivating the soil about their roots which are protected by placing an iron grating over the opening in the pavement so that the pedestrians may not be hindered although the tree is protected. Paris has thus guarded and reared her city trees for years, till she has become famed the world over for her beautifully planted avenues. We plant our trees, gorge ourselves with good intentions, rave about the beauty to be and phone for the gardener with his grubbing mattock, while we prepare a dissertation on "Woodman, Spare that Tree."

However, Californians are not in the habit of satisfying themselves with good intentions but rather pride themselves on their initiative, the fame of which has spread as far as that of the State. Los Angeles has appointed a division of county forestry that has among its duties those of planting out county highways and boulevards with roadside trees. I have no doubt that the members of this commission have worked hard and conscientiously. We know that they have planted miles of our roads with trees that they are caring for carefully—but my, what a choice of varieties to testify to posterity the advanced stage of our development and wisdom in things arboreal. How can we ever look our progeny in the eye as in the future we drive along a boulevard and say to them that we were responsible for having had it planted as it is? For the combinations are pitiful to see. One eighteen-mile stretch of good roads has been planted with Himalayan cedars and California fan palms, alternately, set every forty feet—a case of forced association between a graceful, adopted child of the forests with a living feather duster torn from the sun-baked sands of our own deserts; another longer stretch of pavement is lined by native red woods and southern magnolias also planted alternately—the one being a giant timber tree, loving the cool mountain slopes, the other a native of the humid tropical swamps of our southern States; a third road is planted with pines and live oaks. In the first place the trees thus planted together are not adapted to the same climatic and soil conditions, some of them being entirely unfit for satisfactory growth in the localities where set; in the second place four, with a possible five, of these trees are undesirable for roadway planting because of their characteristic growth; in the third place, two kinds of trees should not be used on the same avenue even though our æsthetic sense demands such a variety But let this much suffice, for we have shown the proper spirit in starting things, and though good intentions will not hurt us much, they are very essential to the accomplishment of good things. And we have once more shown that we, as Californians, have initiative.

Now, this matter of selection of proper trees for such planting is a most difficult one, even for those of us who never make mistakes, since there are a multitude of things to be considered in our choice of varieties. Nowhere else is a tree put to so many tests of efficiency as when it is to be used for street planting. First of all, such a tree should be tolerably drought resistant because the copious amount of pavement surrounding it is sure to interfere with its water supply. It should be of a natural healthy and sturdy growth, unaffected by ordinary insect pests and fungi that attack many of our trees. And it should not be of a rank growing kind that will produce an excess of brittle wood to be torn and broken by the first severe wind to visit the locality. Ideal trees, answering these requirements, are hard to select, but must be found if the question is to be answered satisfactorily.

But a tree that is perfectly hardy and fitted to survive under such stress of circumstances may not be at all desirable for street planting because of its habit of growth, shape of head or production of troublesome litter. I feel that one of the prime requisites of an ornamental and satisfactory street tree be that it produce shade, for I can see no advantage in trees that do not. If shade is not desired, a row of telephone poles or even lamp posts would be much less expensive to maintain and equally as effective as some of the formal effects that are made by planting palms that soon come to resemble a row of sticks crowned with bristles. Our most beautiful drives are those that, having become shaded by old trees, soften the glare of our summer sun and offer a restful retreat from its heat, being so far more attractive than our canyon-streets, walled with trees of perpendicular or pyramidal growth, as to be obviously preferable. Then in order that it may afford shade for a street, the tree should be of an upright habit so that it will grow away from the sidewalk and yet shade it. I am sure that pedestrians and autoists alike find nothing more annoying than constant brushing and scratching of trees that have been insufficiently pruned. Similarly, trees producing litter are to be avoided, as a littered pavement is always unsightly, sometimes dangerous to the pedestrian and above all a nuisance. It thus seems wise to choose not only a tree that exists under such unnatural conditions, but also to select one that will fulfil the requirements of an efficient and desirable tree.

After deciding on the variety to plant, we quite commonly dig a post hole in the hard ground into which we insert a small plant, expecting it to grow. This is the cheapest way to plant but the most expensive way to rear trees, thus enabling us to live up to our reputation of sparing no expense in the beautification of our city. The care that many of our trees receive after this manner of planting comes as a luxury to be enjoyed only on rare and memorable occasions. However, there are so many opposing forces that combine in their efforts to undermine the health of the street tree, that it seems only fair for us to apply our wisdom and knowledge to the best advantage of our foliaged friends. For instance, most streets, especially where they have been either excavated or filled, contain very poor soil, often clay or adobe, that contains little plant food, besides being hard for the roots to penetrate ; the roots are generally deprived of sufficient moisture because of this hard soil and because the pavement keeps away much of the natural rainfall ; the soil around the roots becoming packed, does not permit their proper aeration ; salt water is often carelessly poured near the roots of trees in our city streets ; illuminating gas may sweep through the soil, injuring the roots if not destroying the life of the plant ; injurious gases in the air, damage from overhead wires or the gnawing of horses may all conspire to injure the tree. These things work against the healthy, thrifty existence of these children of the forest transplanted into an unnatural city environment, undermine their health, threaten their very lives, so that we should bend our efforts to prevent and overcome such detrimental influences.

One of our local horticulturists and botanists is fond of saying that a ten-cent tree planted in a fifty-cent hole will soon outgrow and always surpass in healthful vigour a fifty-cent tree planted in a ten-cent hole. He is quite right. Too much attention cannot be given to the preparation of the soil bed that acts for the plant as does the foundation for a building ; for it lies at the bottom of the tree's health, theoretically and literally. Where the soil is poor, a hole should be dug three to four feet deep, sometimes as long as twelve or fifteen feet, and filled with light, loose, rich loam obtained especially for the purpose. If a hardpan exists anywhere near the surface of the ground, the bottom of the hole should be shot with dynamite to crack this layer, thus assuring drainage and conservation of the moisture. Now such preparations seem rather extensive and expensive, but nevertheless become capital stock for the city that really desires to have avenues of beautiful trees, for they will save much later expense that would otherwise become necessary, aside from greatly increasing the growth and beauty of the trees.

Now that we have set the tree it might be well to see what we have planted, though this does not generally seem to worry the planter very seriously. I, personally, feel that trees of pyramidal or straight, slender habits of growth are not satisfactory as street trees in California, for they not only afford no shade, but they shut out the wind, reflect the heat from the smooth pavement and add a stiffness and formality to the landscape that detracts from its beauty and becomes monotonous. Most of the palms and conifers fall quite naturally under these two heads and are also being quite generally used as roadside trees.

Take the Himalayan cedar (*Cedrus deodara*), which is a handsome and graceful tree in its place, when planted as an avenue tree. In the first place, it must be allowed to retain all of its lower branches if it is to retain its graceful charm, thus necessitating its being planted along country boulevards that do not have sidewalks paralleling them. In the second place, it encloses the street between two shining green walls that furnish no shade the while they reflect and counter-reflect the radiated heat of the sun. It is of an inimitable beauty as a specimen or lawn tree where it can expand as nature intended, but planted along an avenue, it poorly serves a purpose for which it was not intended. This cedar serves as an example of the conifer type which is quite commonly, though, I think, unwisely, used in our roadside plantings.

While the palm will grow up and away from the sidewalk and street as the conifer will not, nevertheless it fails in the requirements for a tree suitable to plant along drives of any considerable length. Where formality is desired, or if planted along short or curved stretches of driveway, the palm is very beautiful. But it does not accord with my ideas of an ideal boulevard tree, because it lacks an umbrageous head and possesses an excessive expanse of bare trunk that becomes monotonous to the eye. Although while young, many of the palms seem very graceful and beautiful, as they age and shed their old leaves leaving nothing but a bare trunk surmounted by a tassel high above the ground, they present an appearance that becomes tiring if viewed continuously for miles along a country road. The same fault is to be found with the Italian cypress (*Cupressus sempervirens*) and the poplar trees that grow perpendicularly into the air with scarcely any lateral branches. So, in a general way, I would discourage the planting of palms and slender types of trees along avenues of any length.

In relation to street and roadside planting in California, much is said in favour of planting evergreens and nothing but evergreens, even though some of our most beautiful shade and avenue trees are deciduous. Especially along the sea coasts, where the winters tend to be damp and foggy, would it seem to be advisable to plant an occasional street with a deciduous variety that

would admit the light and air during the winter months when the roadways and walks are so apt to be damp and disagreeable. At the same time, such a tree would afford shade in the summer when it is most needed. Some of our most beautiful shade trees are deciduous, and I do not think that it gives our landscape a bleak or desolate appearance to possess an occasional clump or avenue of trees that are without their leaves for a few short months of the year. As a matter of fact, it rather tends to afford contrasts with our evergreens, making us realize all the more the wealth of possibilities that our State affords for the growth of different types of flora.

In considering trees that would be fitted to live in our city streets we are confronted with a somewhat more serious problem, because of the necessarily cramped space that does not allow either proper root or proper head development of large trees. One of the saddest mistakes that can be made is to plant a large growing tree in a narrow, cramped street that eventually becomes filled and clogged with its branches. Therefore, we should constantly bear in mind the sense of proportion so that the trees which we plant might appear to the best advantage. Tables have been worked out by municipal specialists who give the proper sizes of trees to balance and harmonize with streets of certain widths and lined by buildings of certain heights. These are obtainable by the person who cares, so that excessively bad mistakes need not be made.

For city planting, the Acacia has been used very much throughout the State, many times in much inferior varieties. As a general thing it has so brittle a wood that it is easily broken by the wind or the weight of its own flowers. Some varieties, especially *A. melanoxylon*, the black wood Acacia, sucker from the roots, thus becoming very troublesome in the parkways. There are kinds, however, that if given proper and intelligent care make a very attractive tree that is well worth one's bother. The vast number of varieties of this genus permits much leeway of choice.—Ralph D. Cornell in the Pomona College Journal of Economic Botany.

WEEDS.

G. H. ADCOCK, F.L.S.

To define a weed is not so simple as it looks. Very many are the definitions given. It has been described as "a useless plant"—"a plant that is useless and troublesome." Bailey says it is "a plant that spreads and thrives everywhere." One dictionary describes it as "plant that grows where it is not wanted, and is either of no use to man or injurious to crops." Another, "any useless or troublesome plant which occurs without intentional cultivation." Percival calls it "a plant whose growth interferes with that of the crops to which the soil for the time being is devoted." Hodge says it is "a plant that persists in growing where it is not wanted." Most definitions give weeds as a class a bad character, and charge them with being useless, troublesome, and injurious interlopers with no very honourable intentions as regards our crops. But there are agricultural authorities who do not thus condemn weeds wholesale. Bailey writes, "They have been an inexorable priesthood, holding us to duty whilst we did not know what duty was, and they still stand ready to extend their paternal offices. . . . Weeds have always been the best friends of the farmer. They taught him how to till the soil, and they never allow him to forget the lesson. . . . A plant which becomes a weed is only a victor with farm crops, and if the farmer is in command of the vanquished army it speaks ill for his generalship when he is routed."

To the botanist weeds are interesting. Their clever devices for sending their seeds abroad, their impudent aggressiveness, their cool appropriation of the food and space intended for more worthy plants; these and many other qualities render them almost attractive.

The farmer, too, finds they take up a good deal of his time and thought, for, as a lea'ned church dignitary once said, "Agriculture is a controversy with weeds.' Before man upset the balance of nature, plants only grew where they were best suited, and there were no weeds. We remove the vegetation nature has taken ages to establish, and introduce for our own purposes plants of greater economic value to us. Any plant that interferes with these specially favoured plants of ours we call a weed. From anxious weeds the losses have been so severe as to necessitate legislation to deal with their eradication. Under the Thistle Act the Governor in Council has power to proclaim any offending plant a thistle. This leads to some confusion. The difficulty might easily be overcome by declaring such plants "noxious weeds." In their original native home, before any artificial alterations were made, no plants were weeds. Introduced—for the most part our weeds are aliens—into our fertile soil and under our genial climate, they thrive amazingly, become aggressive, crowd out native and other herbage, and prove remarkably good colonizers, if not good colonists. Examples support this in the Lantana and Prickly Pear of Queensland, the Stinkwort of South Australia, and the St. John's Wort of Victoria. These are instances of the permanent settling down of these aliens. In the St. John's Wort we are face to face with, perhaps, our most serious weed problem in Victoria, because, like Tarquin and the Sibylline books, we have treated the subject with indifference.

Where will the hardy invaders not thrive? We find them in abundance along the waysides and inhabiting waste places, where nothing else seems willing to grow. They push their way through the gravelled path and the hard metalled highway. Even in the narrow spaces between the "pitchers" of the municipal drains they obtain a footing. Nature leaves no vacant spaces. If we will not profitably employ the ground, she will plant her weeds. A well-known professor has written charmingly of the botany of a railway station, and described the plants that have established themselves along the platform. But it is, of course, in our arable and pasture lands and gardens that these persistent interlopers find their most congenial location.

Some of the reasons why "Agriculture is a controversy with weeds" lie in the fact that they are decidedly harmful to our crops. Weeds crowd the crop plants and prevent them obtaining adequate supplies of light and air. They rob more desirable plants of space, and by smothering useful plants interfere with their proper development, for by far the larger percentage of the plants' need is obtained from the air. Besides thus crowding weeds also rob the cultivated plants of the natural and valuable constituents of the soil. They also eagerly assimilate the more costly plant food added to the soil in the form of manures for the sole benefit of the growing crop. But probably the chief crime of these unwelcome intruders, from an agricultural stand-point, is their barefaced theft of moisture. Water supply, so essential, not only for the quantity utilized by the plant, but also as the only means of conveying foodstuffs from root extremity to topmost leaf-tip, is greedily absorbed by these insatiable plunderers, and the legitimate claimants have to go on short commons.

If we examine a leaf under the microscope, we shall find, particularly on the underpage in most cases, an almost incredible number of tiny openings called stomata (literally mouths). From these transpiration takes place. Every plant is, in fact, an elaborate, almost automatic, pumping machine. It has been estimated that foliage gives off many hundred times more moisture than an equal area of surface of a liquid. When we remember

this, and notice the rapid evaporation of the latter, we shall faintly realize the immense amount of water diffused into the air by the transpiration of plants. Let us also not forget that this moisture liberated from the soil by weeds is at the expense of the present or subsequent crop. What a neglected fallow means we all unfortunately know. The want of cultivation and the presence of weeds are both responsible for heavy losses of soil moisture. The small return weeds make when turned in under the plough cannot compensate, under our somewhat limited rainfall, for the heavy toll they have exacted on the soil's water supply.

If weeds are permitted to come to maturity with the crop, some of the seeds drop, eventually grow. Others are gathered, and present themselves in the sample of seed harvested to the depreciation of the market value of the grain. If these samples are sown without careful grading, fouling larger areas as well as the original field is the penalty next seed-time. The necessity of using only pure, clean seed, true to name, has been too long overlooked. It is almost criminal, and it is certainly false economy, to use lower-priced seed that may introduce serious pests on our farms.

Some weeds are parasitic. They live on, and at the expense of the host. Every one is, unfortunately, only too familiar with Dodder and its disastrous effects on lucerne. Among our scheduled weeds are two species of Native Mistletoe. These are responsible for serious damage to fine timber trees. Another reason why weeds are so objectionable to the rural producers is from the fact that they encourage other pests. Insects and their eggs, as well as the minute spores of destructive fungi, are harboured by them. The Rutherglen fly or bug finds congenial shelter among sown thistles and other weeds, whence the insects sally forth to the adjacent fruit trees and ruin the crops. The Shepherd's purse is a favourite host for a rust fungus, destructive to all the cabbage tribe. Appalling losses have been caused by such pests, and much might have been obviated if there were no weeds or accumulations of rubbish to shelter them.

Other weeds are dreaded by the dairy farmer because they communicate an objectionable taint to milk and its products. Charlock, and in fact the whole cabbage family, might be included in the category. Cape-weed is another alleged offender in this respect. The seeds of several of our noxious plants cause immense losses to the important pastoral industry by depreciating the value of the wool, and in some cases actually endangering the sight and even the lives of the sheep.

A few weeds—and their number apparently lessens as our knowledge extends—are poisonous, and cause the death of domestic animals. Of the aggressiveness of these unwelcome plants we have, unfortunately, many examples. Prickly Pear, Stinkwort, Furze, St. John's Wort, Onion Grass, certain thistles, and many other plants soon take complete possession of the land, if not actively and persistently fought. It is always an ominous sign if a new introduction is left severely alone by grazing animals. It is a distinct warning to the grazier to take prompt action to eject the undesirable settler. The Water Hyacinth, with its beautiful flowers, affords a pretty sight. But it is proclaimed a noxious weed, for it takes possession of and actually blocks water-courses, as may be seen in some parts of the Commonwealth. A competent authority emphatically declares that fully one-third increase in the yields of American farms could be secured by preventing the growth of weeds. He further asserts that the extra production, if weeds were eliminated, would represent an amount more than sufficient to pay all taxes. No doubt this applies to other farms as well as American.

To carry plants to new localities, almost everything that moves has been utilized. Weeds have shown their remarkable adaptability by availing themselves of any and every possible means of wide distribution. Birds

help to keep weeds in check by devouring seeds. But they also assist in disseminating them. Most will remember DARWIN's interesting investigations on the subject. The emu has been credited with having distributed the obnoxious Prickly Pear over wide areas in Queensland. In the Geelong district bulblets of the pernicious South African Wood Sorrel were carried by sparrows. In fact, many plants are scattered in the form of seed by our feathered friends. Mud attached to the feet of aquatic birds has been found to contain seeds of many species of marsh-loving plants. Soil from wheels of drays and waggons, carriages and motors, bicycles and perambulators, on examination, will often reveal seeds. Our agricultural implements transport a considerable share from field to field. Rivers, creeks, and irrigation channels bear seeds along the streams. The sea itself is a well-known agent in the dispersal of seeds, some of them representing weeds. We have seen seeds borne on racing currents sweeping between reef-engirdled islands in the tropics, where with anchors down and steam up, the boat was ready for any emergency. A mattress washed up from a wreck on King Island brought the King Island Melilot seed ashore. The wind carries myriads, especially such as are provided with wings, or sails, or parachutes. Icarus dropping because he has lost his wings in mid-air is typical of many seeds. Furze and other pod-bearing plants eject their seeds to a considerable distance by a contraction or twisting of the pod. Tumble weeds have no time to lose in their advance to found new colonies. Every animal carries seeds on its coat of fur or wool or hair. We see them attached to the manes and tails of our horses. Even insects such as locusts carry seeds. We ourselves are perhaps the worst offenders, as these hooked and prickly seeds steal a ride attached to our clothing. These are cast off probably in a new locality. Every ship brings stowaway seeds. Every case with straw packing harbours others. Several seaside plants and the King Island Melilot were transmitted across the State in truckloads of seaweed. Every sample of impure seed introduced to a district does incalculable harm. DARWIN says Docks were introduced to New Zealand by a rascally seed merchant who sold the seed for that of tobacco. Dodder comes with lucerne and clover seed, and weeds of all descriptions are scattered broadcast with every sample of adulterated or carelessly cleaned seed. The manure collected from town stables, and the contents of rubbish bins where packing is emptied, often introduce previous unknown as well as commoner weeds to the farm. Vigorous weed communities round the manure heap attest this. These are some of the many means by which weeds are spread. But for limitations of time and space, almost innumerable examples could be given.

For the suppression of weeds there is practically only one cure, and that is cultivation. It is noticeable how clean a grain crop is when it follows in the rotation a worked fallow or crops such as roots, sorghum, etc., which are cultivated. ALLEN says that in parts of China and Holland weeds are almost unknown. This is due to the dense population and the consequent necessity of tilling every available foot of land. "Weeds," says BAILEY, "are never serious where lands are well farmed." Certain weeds, too, are vigorous for a time, and then seem to wane. Possibly the land gets sick of the weed as it does with such plants as clover. Some weeds with food reserves in underground stems can only be destroyed by refusing to allow them to form leaves.

Birds devour immense quantities of weed seeds, and so materially arrest their abnormal production. Chemicals are sometimes used, but they are apt to render the land for a time unprofitable, while if poisonous they endanger the lives of stock. A novel method of destroying weeds along railway tracks comes from Illinois, America. A brush heavily charged with electricity is drawn along a few inches from the ground. Every plant touched is killed, and the cost of treatment is said to be insignificant.

It is proposed to enumerate some of the commoner weeds found in this district. Referring to the scientific or botanical name of the plant, it will be noticed there are two, which have sometimes been compared to our surname and Christian name respectively. The first plant name is that of the *genus*, which includes plants that possess the same constant general characters. The second or specific name records more or less individual or minute characters. Again, allied genera are gathered together into larger groups called natural orders. If we examine the flowers of sweet-briar, bramble, raspberry, almond, cherry, apple, and pear, we shall find certain striking resemblances. These all belong to the order Rosaceæ. The sweet-briar is in the genus *Rosa*, from which the order is named. To distinguish it from others of the same genus, its individual name is *rubiginosa*. This is given from the glandular rusty red hairs of the young leaves. The bramble and raspberry belong to another genus of the Rose family called *Rubus*. The almond, cherry, peach, and plum belong to the genus *Prunus*, and are each distinguished by individual or specific names. These botanical names are not given haphazard. Take *Convolvulus arvensis*, L., the troublesome Bindweed. The generic name refers to the twining habit characteristic of these plants. The specific name records the fact that this particular convolvulus has a liking for arable land. Another common weed here is the red flowering creeping Mallow. This is botanically *Modiola multifida* (Moench). The first name is Latin for the nave of a wheel, and was given because of the arrangement of the fruitlets. The second name refers to the divisions of the leaf. So we see there is almost a history of the plant hidden in its somewhat unattractive name. Sometimes, however, it must be admitted the names are not so descriptive, but are given in honour of the discoverer, or some more or less worthy person. Occasionally the same plant is described by two botanists independently under different names. To prevent confusion, and to indicate clearly the plant meant, it is usual to place the name of the botanist after the name he has bestowed.—JOURNAL OF AGRICULTURE, VICTORIA.

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THE EFFECT OF ONE CROP UPON ANOTHER.

BY THE DUKE OF BEDFORD AND S. U. PICKERING.

The effect of growing grass over the roots of fruit and other trees has been under investigation at the Woburn Experiment Fruit Farm, Ridgmont, since 1895, and the Thirteenth Report of that Farm, 1911, contained a general account of the results obtained up to date.

There is no doubt that this deleterious action of grass varies greatly with the nature of the soil, though it is questionable whether in any case the effect would be nil : it is considerable even when the trees and grass are grown in pure sand, and fed with artifical fertilizers. It varies in extent with the nature of the trees, though none have yet been found which are not seriously affected by grass, under certain, and, generally, under most, circumstances. In the same way, the nature of the grass—eighteen varieties were examined—has only a minor influence on the results, the action of the weaker and shallower-rooted grasses being still very considerable.

At the Fruit Farm, which is situated on the Oxford clay, the effect of grass is nearly, and often actually, fatal to trees. Young trees grassed over at once after planting have their growth almost entirely arrested, and the grassing of trees which had been growing vigorously in tilled soil for four years, in one case, and for twelve years, in another, was found to produce the same result, the trees in the case of several varieties being actually killed. The effect of grass is noticeable even when a very small proportion of the roots of a tree are in grassed soil; but, on the other hand, recovery from the effect begins as soon as ever any of the tree-roots find themselves in tilled ground.

The stunting action of the grass is accompanied by other indications of starvation; the foliage and bark are of an unhealthy, light colour, and there is a marked deficiency of green colouring matter in the fruit; but it is a case of starvation in a land of plenty, for, not only were all the experiments arranged so as to prevent the soil from being impoverished by the grass, but it has been found that the soil under the grass is actually richer than that in the tilled plots, and, if samples of two such soils are taken, and trees grown in them, those in that from the grassed plots exhibit about twice the vigour of those in the soil from the tilled plots.

The possibility of explaining the results by a difference in the water-contents of the grassed and tilled soil has been negatived by numerous experiments, both with trees grown in the open, and with others grown in pots, where the water-supply—and also the food-supply—could be strictly regulated. In some of these latter experiments the grass-roots were prevented from intermingling with the tree-roots by placing a piece of fine gauze between the two; yet in spite of this, and in spite, also of all water and nutriment being supplied from below, so that the tree got all that it wanted before any reached the grass, the effect of the latter was nearly as great as in other cases.

Other possible explanations have been investigated, but have all been found to be insufficient: these included the questions of soil-temperature, alternation in the aeration of the soil, accumulation of carbon dioxide in it, its alkalinity or acidity and any alternation in its physical nature. The apparent absence of possibilities, combined with the general features of the action, led to the conclusion that this action must be due to some toxin produced by the grass; not necessarily, however, to any actual excretion from the roots for a toxin might be produced either by the decay of the debris of the growing roots, or as a result of an alternation in the bacterial contents of

the soil incident on the growth of the grass. It was possible, too, that the grass might become virtually toxic to the trees by taking up from the soil certain of its constituents, and thus modifying the character of nutriment available for the tree; but this possibility has been excluded by some experiments in which trees were grown in pots of earth, with trays containing growing grass resting on the surface: the trays were perforated, but the roots of the grass were prevented from penetrating through the holes by a layer of fine gauze; thus, if the grass still had an action on the tree it could not be due to anything being extracted by the grass from the soil in which the tree was growing, but must be due to what passed down from the grass to the tree in the water applied in watering the grass. That there was such an action was undoubted: taking the three years' results over which these experiments extended, the average vigour of the trees with the trays of grass above them was only 73 per cent. of that of similar trees with similar trays of earth without grass; and the effect of the grass in the trays was not much less than that in cases where it was grown above tree-roots with no trays; thus, where there was a sheet of gauze separating the grass-roots from the tree-roots the vigour of the trees was 71 per cent. of that of those without grass, and where there was neither trays nor gauze it was 60 per cent. It may further be added that the effect of the grass in these experiments was approximately the same whether the pots and trays both contained earth, or both sand; also that no certain difference was observed whether the trays contained grass germinating *in situ*, or grass which had been germinated some time before the trays were placed over the tree-roots.

In these experiments the leachings from the grass would reach the tree-roots in a very few minutes, but in two other sets of experiments the grass was grown in trays away from the trees, and the leachings were not applied to the latter till after they had been exposed to the air for an hour or two, an opportunity having thus been afforded for the oxidation of any toxin in them; here the results were the reverse of those in the former case, for the trees were benefitted by the leachings to the extent of 30 to 40 per cent. in the two series.

The conclusion from this is obvious: the effect of the toxin formed by the grass is eventually overpowered by the beneficial effect of some other substance formed, which other substance is, doubtless, as in the case of heated soils, merely the oxidation product of the previously formed toxin itself. This is in harmony with the observations recorded above that the leachings of growing grass, if oxidised, are beneficial, not toxic, and that the soil removed from grassed ground is more favourable to the growth of trees than that from similar tilled ground.

Recovery from the toxic effect may not always occur, for this effect may have been so great that the plant is permanently injured. This was apparently the case with the tobacco plant under clover. With hard-wooded plants, also, recovery is improbable, for a severe check to growth during their early years leads to permanent stunting, from which, as is well known, they rarely recover. This is why no instances of recovery from the grass effect have been noticed under ordinary circumstances with fruit trees at the farm. But it explains the recovery which is being noticed there in one exceptional case where the grassing occurred gradually throughout several years, and where the check to growth was much less than in the other cases where the ground was grassed at once.

The present explanation of the grass effect is quite in harmony with the great variations exhibited under different conditions. The toxic action will be increased where the grasses are of the stronger growing class, as has been found to be the case, and will be less effective on the stronger growing varieties of trees, which has also been found to be the case at Woburn. It

must necessarily vary with the character of the soil: if this is rich, or of great depth, or if it favours the oxidation of the toxin, this latter will be less injurious: at the Woburn farm the soil is shallow, not very rich, and very difficult to aerate consequently the toxic action is great: at Long Ashton the reverse conditions obtain, and the toxic action is small. In the only case where we have noticed no toxic action (at Harpenden, *Thirteenth Report*, *p.* 4) the soil is very rich, being old garden soil. Even at Ridgmont, manure lessens the toxic action, though it does not by any means do away with it (*loc. cit.* p. 71). In the pot experiments with tobacco, it may be objected, no connection between the extent of the toxic action and the richness of the soil was noticed, but in that case ample food material for the growth of the plants was added in all instances.

In short, all the observations made at Woburn during the last eighteen years are in harmony with the explanation of the grass-effect now given.

The experiments on the effect of a crop on itself have not yet been extended so as to show whether recovery will eventually take place in such cases also. No doubt it often will, but seeing that the toxic effect is greater than where the plants are different, it will be slower, and may not always occur. It is a well-known fact that with agricultural crops, especially when arranged in well-defined plots, the plants in the centre of a plot are at first less vigorous than those in the outside rows, and this may be attributed to the toxic action of the neighbouring plants being only half as great in the outside rows as in the centre of the plot: but this is noticeable only in the early stages of growth; when the crops are mature such differences seem to disappear (though exact observations on this point are wanting), the toxic effect possibly having given place to the beneficial effect of the oxidised toxin.—JOURNAL OF AGRICULTURAL SCIENCE.

OIL PALMS.

"The advanced prices of palm kernels would naturally have led us to look for greatly increased supplies as instanced in rubber," urge MESSRS. BIGLAND, SONS AND JEFFREYS, of Liverpool, "but so far indolence of native labour, and time to establish estate production, have prevented the output from keeping pace with the demand." Consumers, therefore, must and will continue to study every scientific process possible to enable them to substitute lower-priced oils for those that are too high to pay them to work, since the retail buyer cannot or will not pay above a certain price. Force him to do so and he curtails his purchases, even to the extent of going without, as big concerns have done with copper and tin in company with the poorest man, woman and child in connection with their supply of tobacco, tea and soap. For these reasons this country cannot and must not allow the oil palm plantations industry to be neglected, otherwise the same as with the soya bean and oil industry in this country (see the May issue of TROPICAL LIFE, p. 94), we shall lose the chance of developing important new industries just when our enormously increased taxation renders it important that new industries should be started and established, or developed and extended, and we shall lose the chance for a reason that should not exist, i.e. on account of the lack of adequate regular supplies of the raw material. With the soya oil trade the loss of a promising business has been regrettable enough, but should our supplies of palm oil and palm-kernel oil take to falling short, then the consequences will be most serious, not only on account of the loss of trade and revenue that would ensue, but also on account of the serious discouragement to cleanly ways and hygienic ideas that dear soap would spread among the

lower classes, which it is necessary at all costs to keep up to the present day's standard of cleanliness—a standard that has cost so much trouble, time, patience, and money to establish, and which we hope will further advance, and not go back.

As we cannot help feeling at times that far more individual capitalists would turn their attention to the cultivation of oil-palms were they more fully aware of the soundness and security that a well-managed oil-palm estate offers to its owner, provided that he (1) secures the right soil; (2) the right variety of oil-palm, and (3) that he does not pay too high for the land, we think it would not be amiss to give a few details concerning the industry. As we acknowledge the sources whence we draw the information those who wish for fuller details can study the works mentioned, or even write to the authors for any information required.

"Owing to its extensive and peculiar root development," we understand from MR. BECKWITH, "the oil-palm will grow under the most unfavourable conditions of soil and moisture, though not with any great amount of success. It does not, however, succeed where the rainfall is below 50 in. per annum, nor in swamps, nor on poor soils. To obtain the best results it requires a heavy, well-distributed rainfall of from 70 to 100 in. per annum, and a moist, fairly equable climate with a deep holding soil; these conditions are found in the deep alluvial humus-covered soils of the forest regions of West Africa and along the coast inward for a distance of 70 to 150 miles. It does not grow at high elevations; on the Cameron mountains, for instance, it disappears after a height of 3,000 feet above the sea level." MR. MILLIGAN, in his book, gives very full particulars of the root development of these palms, and the soil which induces them to give the best results.

On pp.34-36 of MESSRS. BILLOWS & BECKWITH'S book we are told that, according to FARQUHAR, an average cone of palm fruit weighs 31 lb.; the fruit alone weighs 20 lb.; the stalk refuse weighs 11 lb.; average number of fruit per cone or bunch, 1,600; average number of bunches per palm (S. Nigeria), 5; but it is common to find trees yielding many more, even eleven having been seen on one palm at the same time.

Again quoting MR. MILLIGAN, we are told: "By the time it has reached its tenth year of growth the oil-palm is fully matured and will bear up to twelve régimes or bunches per year. Indeed, there have been well authenticated cases where a cultivated palm has yielded as many as twenty régimes within the twelve-month." Against this MR. BILLOWS gives the following figures, based on his personal experience: An average cone of fruit weighs 23 lb.; the fruit alone weighs 16 lb. the stalk refuse weighs 7 lb.; average cones or bunches per palm, per year, 3; average density of bearing palms, per acre, 50.

On the basis of MR. BILLOWS' figures, an acre of land, therefore, should give 2,400 lb. of palm fruit per annum, say, 50 palms by 3 bunches each, 16 lb. net of fruit. Then, turning to the composition of the fruit, we are told that, on an average, it contains:—

Pericarp oil	...	18 per cent.	
Fibre and moisture	...	12 ,,	
Shell and dirt	...	58 ,,	
Kernel	...	12 ,,	= Whole fruit 100 per cent.

On MR. BILLOWS' figures, therefore, 2,400 lb. of palm fruit with a total percentage of 18 per cent. pericarp oil, or, say, a commercial yield of $16\frac{3}{4}$ per cent., should give 402 lb. palm oil (1 gall. = 8·2 lb.), and 1,000 tons of palm oil should cost (as per table given on p.36) £14,770 to produce, less 4,200 tons of palm nuts resold to the natives at 10*s.* per ton=£2,100, plus £3,000, say, £3 a ton, to cover English staff expenses, office rent, directors' fees, etc., gives £15,670 actual cost, equal to £15,134 of fine, soft palm oil, delivered Liverpool.—TROPICAL LIFE.

THE DATE PALM

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The amount of labour and care required by the date palm is much less than that necessary for any other fruit trees. The gathering of the fruit is performed easily and quickly by cutting off a whole bunch at a time.

"The Date Palm is almost as important as a shelter and partial shade or other trees and plants as it is for its own fruit."

We Supply Date Palm Seeds of two varieties at the following prices:

Phoenix D. Sapida, a strong and resisting tree, demands no special care, but yields plenty of nice and soft fruit:

On receipt of 3 Shillings we forward about 10 ounces seeds (in full fruit) as sample of no value, under registered postage paid.

On receipt of £1.-,--Sterling=10 lbs. nett, by parcel post, postage paid.

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On receipt of £1.5.--Sterling=10 lbs. nett, by parcel post, postage paid.

Prices for quantities on application. Detailed instructions for cultivation with every order.

Never buy Date Seeds in Kernels, as such, i.e., without the pulp, they easily lose the germination power and offer no guarantee that the trees will produce soft dates, for a dry or hard date is absolutely valueless.—We therefore supply date palm seeds only in the original fruit.

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BACTERISED PEAT.

The result of PROFESSOR BOTTOMLEY'S investigations of the causes of the remarkable stimulative action exercised on plant growth by bacterised peat were communicated by the author to the Royal Society on Thursday, June 18.

PROFESSOR BOTTOMLEY has obtained evidence which leads him to suggest that the stimulating effect is due to the formation or liberation during the preparation of bacterised peat of minute quantities of substances which play with respect to plant growth a part similar to that played by the so-called accessory food substances in the nutrition of animals. By appropriate methods he has isolated from bacterised peat substances which, when added to the medium in which plants are growing, increase the rate of plant-growth in a remarkable manner. He finds, moreover, that these accessory food substances are essential for the continued life of seedlings If, for example, seedlings are grown in pure distilled water, to which are added all the mineral substances which ordinarily suffice to bring about active growth, he finds that though the seedlings at first gain weight they subsequently lose weight and die; whereas if in addition to the complete mineral "food" there be added an extract containing a small amount of the accessory food substances, the growth of the seedlings is considerable and continuous.

Plant physiologists will require overwhelming evidence before they will be prepared to except this conclusion; for many of them have used distilled water and pure chemicals for the purpose of water cultures and have found that plants may be raised from seed to seeding stage although the water in which they grow contains nothing but mineral salts. This objection, however, is not fatal to PROFESSOR BOTTOMLEY'S hypothesis, for it is quite in accordance with physiological experience that an organism may be able, given appropriate conditions, to manufacture its own "growth stimulators." Indeed, the fact that the accessory food substances necessary for the nutrition of animals are derived from plants makes it highly probable, if not absolutely certain, that these substances are manufactured by the plant. Hence it is but natural to suppose that the accessory food substances, formed by the plant, play in the economy of the latter the same rôle as that which they play in the animal that feeds upon them.

The fact that seedlings may be grown in ordinary tap water, to which the necessary mineral substances have been added, is interpreted by PROFESSOR BOTTOMLEY to mean that the tap water, owing to its contact with soil, contains traces of these growth-stimulators. PROFESSOR BOTTOMLEY'S researches open up a new and an extraordinarily interesting chapter in plant-nutrition, and if, as the result of further inquiry, his conclusions are established he will have laid both botanical science and horticultural practice under a deep debt of gratitude. It is at present premature to express a definite opinion on the subject of accessory plant-food substances, but it may be said with confidence that PROFESSOR BOTTOMLEY has made out a *prima facie* case for the existence of such substances. We have on the one hand the argument from analogy: the existence of accessory animal-food substances having apparently been demonstrated to the satisfaction of physiologists; and on the other hand we have the striking evidence already published in these columns (TROPICAL AGRICULTURIST, June, 1914, p. 490) that bacterised peat actually exercises a definite stimulatory influence on plant growth. At the present stage of the inquiry, the best criticism is constructive, and should consist not in arguing the pros and cons but in repeating and extending the experiments begun by PROFESSOR BOTTOMLEY. An aspect of the subject of particular interest to horticulturists is this—that gardeners as a class have resolutely refused to believe that artificials are the equals of natural manures. If PROFESSOR BOTTOMLEY'S theories are established that prejudice will receive a real measure of justification; although let us hasten to add even so the justification will be by no means complete, for the poverty of a soil in nitrogen, phosphorus, and potassium compounds cannot be compensated by the presence of accessory food bodies.—GARDENERS' CHRONICLE.

IPECACUANHA CULTIVATION.

Although it is over twelve years since so-called Johore ipecacuanha appeared in regular commercial quantities on the London market (and occasionally for fifteen years before), the offerings have been strictly confined to the output of one grower, the Highlands and Lowlands Para Rubber Co., Ltd., whose territory is situated in the Selangor State of the Malay Peninsula. This company or its predecessors have shipped altogether over 1,800 bales since operations were commenced on a commercial scale, about 1902, the

average imports into London being from 150 to 160 bales per annum, as is shown by the following receipts:—

	Bales		Bales
1913 ...	211	1907 ...	269
1912 ...	115	1906 ...	137
1911 ...	225	1905 ...	176
1910 ...	176	1904 ...	128
1909 ...	100	1903 ...	200
1908 ...	97	1902 ...	20

The methods of cultivation have been jealously guarded by the growers and no one else appears to have been successful in cultivating the drug in the Malay States. The reason for this is not very clear, except it be knowledge that early cultivation of ipecacuanha from young plants sent out from the Botanic Gardens of Kew and Edinburgh failed as regards the Kew plants, while the Edinburgh ones grew, but were forgotten by people on this side of the world until a parcel of ipecacuanha from Johore appeared in the London market in the eighteen-eighties. The success of the cultivation since is apparent from the above figures, and our feeling is that, secret or no secret, the Malay Peninsula is the future field of ipecacuanha cultivation, just as Java is of cinchona. As a rule East Indian ipecacuanha has been sold by auction in London as quickly after arrival as possible at the market price of the day, consistent with fair competition and demand. The output of the drug appears to be controlled at the source, as at no period has the market been overweighted with supplies as has sometimes been the case with other descriptions of ipecacuanha, the danger of over-production having evidently been recognised. The success of the industry has aroused a good deal of interest in the East, but cultivation of the drug is by no means easy, and the growth of the plant is extremely slow, as it is very sensitive to rapid changes of weather. It seems to grow well, but does not produce root in abundance We now learn that serious efforts are being made in another direction in the Selangor State also, a large quantity of cuttings having been received which are to be cultivated on a rubber estate. The ultimate success of the new venture is quite problematical, as it will take about four years before the plants arrive at maturity, and then only will the grower be able to obtain an idea of what the root crop will amount to per plant and per acre. Such an enterprise is worthy of every encouragement, and is one that should prove profitable after the initial difficulties have been overcome. We are able to put any planter in the East into communication with a grower who is able to supply young plants by the thousand, if necessary, with precise information as to the conditions best favourable for the growth of the plants up to marketable condition for the drug.—CHEMIST AND DRUGGIST.

NOTE BY THE EDITOR, T. A.

DR. TRIMEN, who as one of the authors of the standard work on medicinal plants and took especial interest in their cultivation, detailed the history of Ipecacuanha in Ceylon in his Annual Report for 1887 as follows:—

"This very valuable drug has been in cultivation here for many years. The Gardens first received it in 1848 from Kew, and additional consignments from the same source were obtained in 1866 and 1871, whilst in 1874 a hundred plants arrived from Calcutta in good order. Many remarks on its cultivation will be found in DR. THWAITES' reports from 1872 to 1878. So long as it was grown at Peradeniya very little satisfactory growth could

be obtained, and the plants remained very small, but at Henaratgoda the results have been somewhat better. Still, as I remarked in my report for 1880, not much progress, so far as the production of the roots themselves went, could be reported. During the past year, however, as a result of more care in the preparation of the soil and choice of situation for the beds, some roots of much finer growth have been produced, and I do not despair of yet producing of good sample of this important medicine. The plant is propagated with extreme facility by division of its roots, but from its small size and very slow growth it must always be the subject rather of garden than estate cultivation. MR. CANTLEY, in his last report of the Singapore Botanic Garden, notes that in Johore he saw thousands of plants in excellent health grown in rich vegetable soil with wood ashes, and well protected from the sun and wind by palm leaves. I may note that a commercial sample has been imported to London from Singapore (probably from this very plantation) and has formed the subject of analysis, showing a proportion of 1·7 per cent. emetine, which is well up to the average of the Brazilian drug. By order of the Madras Government a plantation is about to be formed in the teak plantation in Nilambur on the Malabar coast."

The Report for 1888 states that a large plantation of this plant has been formed at Henaratgoda in long narrow beds well made up with good vegetable soil and coir fibre under shade: at the end of the year the plants were over 2½ feet high, and root formation was proceeding rapidly. In 1897, there were about 2,000 young plants at Henaratgoda, most of which were available for distribution to anyone who wished to experiment with it. The plants were again offered in the Report for 1898: plots had been planted out that year with little success. Apparently these attempts to secure the cultivation of this drug in Ceylon were fruitless.

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THE ACTION OF CERTAIN NUTRIENT AND NON-NUTRIENT BASES ON PLANT GROWTH.

A memoir containing three papers dealing with the above problems has recently been published by M. M. McCOOL in the series issued from the Cornell University Agricultural Experiment Station.

I. THE ANTITOXIC ACTION OF CERTAIN NUTRIENT AND NON-NUTRIENT BASES WITH RESPECT TO PLANTS.

It had already been determined by several investigators that plants grown in a solution of any one nutrient base and in absence of some other nutrient base, exhibited extremely injurious effects. This was first demonstrated with the important nutrient bases magnesium and calcium: magnesium is an essential of plant food, but in the absence of calcium it has a marked toxic action on the plant, the addition of calcium in sufficient amount completely preventing such toxic action. The toxic action exhibited itself chiefly in retardation of growth of shoot and root. The explanation advanced was that "ions furnished by the dissociation of electrolytes form intimate combinations with the proteids of protoplasm, and that their mutually antagonistic effect expresses itself in a replacement of one kind of ion by another as a result of change in the composition of the surrounding solution." "In a mixture of three salts in the proper proportions, the toxic effects are mutually counteracted. The mixture so constituted is a physiologically balanced solution." The present paper discusses a series of experiments where the nutrient bases employed were calcium, magnesium, ammonium, and potassium, and further the non-nutrient bases sodium, barium and strontium. It was found that calcium is not poisonous even at relatively high concentration, though it caused chlorosis of the leaves: this chlorotic condition is prevented by addition of magnesium. Magnesium is extremely toxic, but is completely antidoted by calcium when present in sufficient quantity: its toxic action exhibited itself in almost total inhibition of growth of shoot and root. Each of the following bases in the order given is injurious to plants grown in pure solutions: barium, strontium, ammonium, magnesium, sodium, potassium. Some of these exhibit mutual antagonism e.g., sodium and potassium, when pre ent together, mutually prevent the ill effects which each produces when present alone. Calcium however is the most effective in preventing these ill effects; probably, the favourable results obtained from the application of lime to many soils is due in part to its antidotal relations.

II. THE TOXICITY OF MANGANESE AND THE ANTIDOTAL RELATIONS BETWEEN THIS AND VARIOUS OTHER CATIONS WITH RESPECT TO GREEN PLANTS.

Salts in solution undergo ionisation i.e., a dissociation of the salt into its component parts, acid and base. The acid part is the anion, the base the cation. Manganese is widely distributed in nature. Fertile soils usually contain less than 1 per cent. of oxide of manganese. Manganese occurs in plants: LIEBIG in 1851 reported the presence of manganese in tea. Later research showed its presence in most flowering plants. Its function in plant nutrition is not clearly understood, but it has been established that it is of importance in the action of oxidizing enzymes. It has frequently been shown that manganese exerts a stimulating action on plant growth, when applied to soils in small quantity. Aso in 1904 applied a general manure to two plots

of paddy, and to one of these in addition he applied a small quantity of manganese chloride. Taking the yield of the control plot as unit, the yield of the manganese plot was as follows:—

Total Yield	..	1·42
Straw ...	...	1·48
Full grains	...	1·36
,, ,,	(husked)	1·30

approximately a gain of one-third.

Other field crops have shown a similar increased yield following the application of manganese: it was also found that manganese is more effective when applied as a top-dressing.

Manganese when present in greater quantity has a toxic action, seen in strong inhibition of aerial growth, while root injury is insignificant. The leaves showed marked chlorosis: apparently the chlorophyll is not developed, consequently the leaves are functionless and the plant soon dies. The chlorotic action of manganese has some economic importance: the "yellows" of pine-apples in parts of Hawaii has been attributed to excess of manganese in the soil: analysis of a black Hawaiian soil gave 9·74 per cent. of manganese oxide. Chlorotic leaves caused by manganese show a greater amount of active oxidases, than is found in normal leaves. Light increases the toxic effect of manganese; in light there is greater transpiration, and a consequent greater accumulation of manganeses in the aerial parts.

Calcium, potassium, sodium and magnesium are each effective in counteracting the toxicity of manganese.

III. TOXICITY OF VARIOUS CATIONS.

The various bases show a lessened toxicity in sand, soil, and other solid particles, than in pure water solution. This may be due to chemical reactions between the dissolved salt and the solid particles resulting in the formation of less toxic substances. Young seedlings are much more sensitive, than are older plants.

Barium, strontium, ammonium, magnesium, sodium, and potassium, in the order given, are very toxic to seedlings. This toxicity is greatly reduced in full nutrient solutions and in soil cultures.

The importance of the above results in the practice of manuring is evident. Equally evident is it, that a knowledge of the composition of the particular soil concerned is necessary. The practice of heavy manuring with potash and ammonium manures may lead to physiologically unbalanced conditions in the soil: or such conditions may already exist in the presence of one of the above bases in excess.

The rectifying of the soil conditions may be most effectively brought about by the application of lime (calcium).

G. BRYCE.

HOW SAPROPHYTIC FUNGI MAY BECOME PARASITES.

G. MASSEE.

It is very generally believed that diseases of plants, caused by fungi, continue to increase in number, and in the case of cultivated plants this is probably true, not because the adaptive power of fungi is greater than at any previous period, but simply because the opportunities for exercising the

adaptive power possessed by fungi are more frequent at the present time, too often due to a departure from the normal on the part of the host-plant, brought about by cultivation.

Quite recently my attention was called to a batch of *Clerodendron fallax*, Lindl in one of the houses at Kew ; the gardener had noticed the presence of numerous minute watery-looking drops, on the under-surface of the leaves, an unusual phenomenon, not to be found on another batch of the same kind of plant growing under slightly different conditions as to temperature and moisture. On investigating the matter it was found that the under surface of the leaf, more especially towards the base, was studded with comparatively large, peltate glands, supported by a very short central stalk. These glands each exuded a liquid drop which had a very sweet taste. The ubiquitous floating spores of *Cladosporium epiphyllum*, Pers., found these sugary drops a congeniai pabulum, and each gland was soon tipped with a fruiting tuft of *Cladosporium*. At first the *Cladosporium* was strictly confined to the glands, and depended on the secretion for its support, but it gradually passed from the saprophytic condition, and entered that of a facultative parasite, passing beyond the range of the gland and attacking the surrounding living tissue of the leaf, forming conspicuous brown, dead patches on the upper surface. Three weeks after the disease first appeared, the spores of the fungus were capable of infecting any portion of the leaf, quite apart from receiving an initial start on the sugary excretion from a gland. The above is a concrete example of a saprophytic fungus becoming a parasite within a brief period of time. It is unlikely that all the conditions necessary to effect this change will ever occur again, hence the epidemic will be of short duration, but it can be readily imagined that if the host-plant had been an outdoor crop, and the epidemic had remained unchecked, the fungus might have become a pronounced parasite, capable of continuing its ravages for all time.

Judging from the number of examples sent to Kew for determination, mechanical injuries of various kinds, often self-inflicted, are a source of perplexity as to their origin. Wind is the most important factor. The gourds that are trained up poles in the herbaceous ground furnish striking examples. When a young fruit happens to be overhung by a leaf, and the latter is gently swayed to and fro by the wind, the rigid hairs on the under surface of the leaf form a series of more or less parallel scratches on the surface of the fruit. As the direction of the wind changes, the series of lines on the fruit cross each other diagonally, or form a more or less regular pattern. Such wounds are not very noticeable at first, but as the fruit increases in size the wounds are torn wider apart and periderm is formed along the edges of each wound, so that by the time the fruit has reached its full size, each individual scratch is clearly outlined by a raised ridge of whitish periderm. The above is what happens if no fungus appears on the scene, but as a rule the wounds while quite newly made are invaded by the spores of some facultative parasite, most frequently *Botrytis* or *Cladosporium*. In this case the original source of injury is soon obliterated, and a soft rot follows.

The leaves of gooseberries are frequently scratched by the spines on neighbouring branches, the sign that wind has been the active agent is indicated by the parallel rows of scars, which become clearly outlined by whitish periderm.

Holly leaves often suffer from the effects of wind, becoming wounded by the spines on the leaves of a neighbouring branch. When actual perforations are made, the injury is usually attributed to some insect. When the leaves are only slightly punctured, the wound often forms a starting point for one of the many micro-fungi attacking leaves, or a growth of periderm gives the leaves a spotted appearance.

The opportunities described above for saprophytic fungi having a tendency to become parasites, must necessarily be repeated in a wholesale manner in nature. In the majority of instances the opportunity is not of sufficiently long duration to enable the fungus to become an obligate parasite, which only means that a fungus has fed for so long a time on food supplied by one special kind of host-plant, that it cannot change, without undergoing at least very great inconvenience to itself, or if it has become rigid, cannot change under any circumstances. For this reason the evolution from saprophytic to parasitic fungi is not rapid, due simply to lack of opportunity, at the same time it cannot be doubted that a certain amount of headway is made in this direction, and the primary factor rendering possible such progress may be of a very trivial nature in itself.—KEW BULLETIN.

INDUSTRIAL RESEARCH IN AMERICA.

Any attempt to present adequately the enormous volume of research work, much of which is of the highest grade, constantly in progress in the many scientific bureaus and special laboratories of the general government, or even to indicate its actual extent and range, is utterly beyond the limits of my attainments or of your patience. The generous policy of the Government toward research is unique in this, that the results are immediately made available to the whole people.

The United States is still essentially an agricultural country, and agriculture is, in its ultimate terms, applied photochemistry. The value of our farm property is already more than 42,000,000,000 dollars, and each sunrise sees an added increment of millions. Even small advances in agricultural practice bring enormous monetary returns.

Chief, therefore, among the government departments, in the volume of industrial research is the Department of Agriculture, which includes within its organisation ten great scientific bureaus, each inspired by an intense pragmatism and aggressively prosecuting research in its allotted field.

The research work of the Department of Agriculture is greatly augmented and given local application through the agency of sixty-four State agricultural experiment stations, established for the scientific investigation of problems relating to agriculture. These stations are supported in part by federal grants, as from the Hatch and Adams funds, and for the rest by State appropriations. Their present income exceeds 3,000,000, dollars. All are well equipped; one of them, California, includes within its plant a superb estate of 5,400 acres, with buildings worth 1,000,000 dollars.

It may be said without fear of contradiction that through the combined efforts of the Department of Agriculture, the experiment stations, the agricultural colleges, and our manufacturers of agricultural machinery, there is devoted to American agriculture a far greater amount of scientific research and effort than is at the service of any other business in the world.

In the United States Patent Office, DR. HALL has developed a remarkably comprehensive index to chemical literature, which now contains 1,250,000 cards, and is open to every worker. The Bureau of Fisheries devotes 40,000 dollars to a single study, and the Geological Survey 100,000 dollars to the investigation of the mineral resources of Alaska.

The Bureau of Mines of the Department of the Interior was established to conduct on behalf of the public welfare fundamental inquiries and investigations into the mining, metallurgical, and mineral industries. Its appropriation for the current fiscal year is 662,000 dollars, of which 347,000 dollars is to be devoted to technical research pertinent to the mining industry.

Perhaps no better evidence could be adduced of the present range and volume of industrial research in America than the necessity, imposed upon the author of such a general survey as I am attempting, of condensing within a paragraph his reference to the Bureau of Standards of the Department of Commerce. Its purpose is the investigation and testing of standards and measuring instruments, and the determination of physical constants and the properties of materials. To these objects it devotes about 700,000 dollars a year to such good effect that in equipment and in the high quality and output of its work it has in ten years taken rank with the foremost scientific institutions in the world for the promotion of industrial research and the development and standardization of the instruments, materials, and methods therein employed. Its influence upon American research and industry is already profound and rapidly extending.

I cannot better conclude this cursory and fragmentary reference to governmental work in applied science than with the words of the distinguished director of the Bureau of Standards:—

"If there is one thing above all others for which the activities of our Government during the past two or three decades will be marked, it is its original work along scientific lines, and I venture to state that this work is just in its infancy."

The present vitality and rate of progress in American industrial research is strikingly illustrated by its very recent development in special industries. It has been said that our best research is carried on in those laboratories which have one client, and that one themselves.

Twenty-five years ago the number of industrial concerns employing even a single chemist was very small, and even he was usually engaged almost wholly upon routine work. Many concerns engaged in a business of a distinctly chemical nature had no chemist at all, and such a thing as industrial research in any proper sense scarcely came within the field of vision of our manufacturers. Many of them have not yet emerged from the penumbra of that eclipse, and our industrial foremen as a class are still within the deeper shadow. Meantime, however, research has firmly established itself among the foundation stones of our industrial system, and the question is no longer what will become of the chemists. It is now what will become of the manufacturers without them.

In the United States to-day the microscope is in daily use in the examination of metals and alloys in more than 200 laboratories of large industrial concerns. An indeterminate but very great amount of segregated research is constantly carried forward in small laboratories, which are either an element in some industrial organization or under individual control. An excellent example of the quality of work to be credited to the former is found in the development of cellulose acetate by MORK in the laboratory of the Chemical Products Company, while a classic instance of what may be accomplished by an aggressive individualism plus genius in research is familiar to most of you through the myriad and protean applications of Bakelite. The rapidity of the reduction to practice of BAEKELAND'S research results is the more amazing when one considers that the distances to be travelled between the laboratory and the plant are often, in case of new processes and products, of almost astronomical dimensions.

Reference has already been made to the highly organised, munificently equipped, and splendidly manned laboratories of the Du Pont Company, the General Electric Company, and the Eastman Kodak Company. There are in the country at least fifty other notable laboratories engaged in industrial research in special industries. The expenditure of several of them is more than 300,000 dollars each year. The United States Steel Corporation has not hesitated to spend that amount upon a single research, and the expenses

of a dozen or more laboratories probably exceed 100,000 dollars annually. One of the finest iron research laboratories in the world is that of the American Rolling Mills Company.

The steel industry in its many ramifications promotes an immense amount of research, ranging from the most refined studies in metallography to experimentation upon the gigantic scale required for the development of the Gayley dry blast, the Whiting process for slag cement, or the South Chicago electric furnace. This furnace has probably operated upon a greater variety of products than any other electric furnace in the world. Regarding the steel for rails produced therein, it is gratifying to note that after two and one-half years or more no reports of breakage have been received from the 5,600 tons of standard rails made from its output.

Industrial research is applied idealism. It expects rebuffs, it learns from every stumble, and turns the stumbling-block into a stepping-stone. It knows that it must pay its way. It contends that theory springs from practice. It trusts the scientific imagination, knowing it to be simply logic in flight. It believes with F. P. Fish, that "during the next generation—the next two generations—there is going to be a development in chemistry which will far surpass in its importance and value to the human race that of electricity in the last few years—a development which is going to revolutionise methods of manufacture, and more than that, is going to revolutionise methods of agriculture;" and it believes with Sir William Ramsay that "the country which is in advance in chemistry will also be foremost in wealth and general prosperity."

Modern progress can no longer depend upon accidental discoveries. Each advance in industrial science must be studied, organised, and fought like a military campaign. Or, to change the figure, in the early days of our science, chemists patrolled the shores of the great ocean of the unknown, and, seizing upon such fragments of truth as drifted in within their reach, turned them to the enrichment of the intellectual and material life of the community. Later they ventured timidly to launch the frail and often leaky canoe of hypothesis, and returned with richer treasures. To-day, confident and resourceful, as the result of many argosies, and having learned to read the stars, organised, equipped, they set sail boldly on a charted sea in staunch ships with tiering canvas bound for new El Dorados.—Nature.

LEUCAENA GLAUCA AS A SOIL RENOVATOR.

This is the subject of a paper (published in the Philippine Agriculturist and Forester) by Antonio Legano the result of whose investigations should prove of considerable interest to the agriculturist.

The plant referred to, commonly known as *Santa Helena* or Ipil-ipil, is found so abundantly in the Philippines that it is looked upon as a weed. It is frequently associated with another plant that has become common in Ceylon since its introduction from Central America about 1885, viz. Madre Cacao (*Gliricidia maculata*).

An important fact brought out in the paper is that Leucæna is able to fight *Imperata* (cogon, lalang or illuk) grass, inasmuch as it quickly shades the latter and kills it out,

Both Leucæna and Gliricidia are spoken of as excellent fuel trees, and well worth growing for that purpose. Indeed, Leucæna is from the forester's point of view "the most practical crop for badly exposed areas." It is recommended for use as a nurse for forest seedlings to be cut later on for fuel. It has been calculated that the Leucæna grown for wood should give a return of P 55 per hectare per annum, i.e., Rs. 33 per acre.

But the most important part played by Leucæna is in renovating impoverished soils by adding to them nitrogen drawn from the atmosphere. The writer of the paper gives the following results of his observations regarding root-nodule development:—(1) The nodules are largely found on the filamentous feeding roots. (2) They are developed laterally and so do not interfere with the growth of the roots. (3) They are not to be found on the larger roots and practically cease at a depth of 5 inches. (4) The nodule-bearing roots are most numerous near or at the surface from which the nodules sometimes protrude like little tubers. (5) The nodules are generally branched; lower down they are fewer in number and scarcely branched; in hard soil they incline to become compressed.

In the course of his investigations the writer ascertained the weight of the nodules (fresh and dried) from four fields, and having also found the percentage of nitrogen in the nodules, he was able to calculate the value of the nodules in terms of the value of the nitrogen contained in them.

According to this computation the average market value of the nitrogen in the nodules for the four fields studied is P. 6·50 per hectare in the United States, and P. 9·30 in the Philippines, i.e., Rs. 3·90 or Rs. 5·58 per acre respectively.

By means of soil examination the rate of production of nodules was also calculated, and the average total cost of nitrogen added to the soil per annum in the four fields was approximately determined as P. 38·80 per hectare for the United States and P. 55·50 per hectare for the Philippines; i.e. Rs. 23·28 and Rs. 33·30 respectively per acre according to the ruling value of nitrogen.

There was some indication that the rate of nitrogen production became less as the trees grew old, though nothing definite can be said on this point. But it would appear that Leucæna is a most useful and valuable plant as (1) a source of nitrogen for the renovation of poor soils, (2) a fuel producer, (3) a nurse for seedlings, (4) a useful shade tree, and (5) a means of fighting illuk grass. On waste land it should prove a remunerative crop which costs practically nothing to establish, and may with advantage be grown on uncultivated areas instead of allowing illuk and other noxious weeds to occupy them and exhaust their fertility.

C. D.

COTTON SEED DISTRIBUTION IN EGYPT.

The Department of Agriculture in Egypt has realised that one of the best means of improving the cotton crop is the selection and distribution of good seed for sowing, and it has therefore devised a plan for carrying this into operation. The system consists of (1) the ordinary distribution scheme under which good "Taqawi" (i.e., seed for sowing as distinguished from "Tugari" or commercial cotton seed) is supplied to the small cultivators, and (2) the States Domains scheme, under which selected "Taqawi" grown on the States Domains is supplied to the largest and most careful cultivators. A full account of both schemes has been published in the AGRICULTURAL JOURNAL OF EGYPT (1913-3-1).

In initiating the ordinary distribution scheme, it was necessary to bear in mind that the fellahin, or native cultivators, are extremely improvident, and will purchase inferior seed on account of its cheapness, and that being in many instances in a needy state, they were compelled in the past to obtain their seed under the onerous conditions imposed by unscrupulous dealers. The Department therefore decided to supply the fellahin with better seed than they had been obtaining hitherto, and at a more reasonable price and under less burdensome conditions. The seed is distributed on credit, and its cost is collected subsequently with an instalment of the land tax. It was also decided to restrict the distribution on credit to the fellahin planting eight acres or less, this being the predominating class of cultivators and the one most in need of the advantages afforded.

The scheme was started in 1910-11, when 1,570 ardebs (1 ardeb = 5·445 bushels) of seed were distributed in the Sharqia Province. In 1911-12 the distribution was extended to the whole of Egypt, and the quantity of seed issued on credit amounted to 39,190 ardebs. During 1912-13 no less than 76,527 ardebs were distributed on credit to the peasant farmers. Nearly every village in Upper and Lower Egypt has been visited by special sub-inspectors, and the system of distribution explained. Applications for seed were received in 1912-13 from more than half the villages in the country. The seed supply is obtained from first class ginners, who realise the importance of the project and the responsibility they incur, and consists of good Taqawi (a) which the ginners provide from crops they have purchased, and (b) which comes from crops which have been inspected in the fields and are recommended by the Department's inspectors. Special arrangements have been made for bagging the seed and for inspecting the seed in the ginneries.

By means of the scheme outlined above, the Department of Agriculture is able to distribute much better seed than the growers could obtain otherwise. There is not at present, however, any highly selected seed available for extensive distribution, and steps are therefore being taken to introduce a pure type of seed in sufficient quantity to replace the deteriorated and mixed varieties now grown. This work is being carried out on the Department's experiment farms, but a considerable time must necessarily elapse before the results will be of practical utility to the general distribution scheme. Meanwhile it has been decided that the States Domains seed should be adopted as a basis, this seed being recognised as the best obtainable in the country because of the great care which the State Domains Administration devotes to the cultivation and ginning of the crops. Arrangements have been made for a certain quantity of the seed produced on these estates to be placed each year at the disposal of the Department. This seed is distributed to the larger cultivators on condition that 50 per cent. of the seed resulting from its growth should be available for the use of the Department. This resultant seed is then sold to medium cultivators on the same condition, and the seed obtained from them enters into the ordinary distribution scheme for the smaller cultivators. To avoid confusion, the original seed from the States Domains is termed "Domains Taqawi," the seed resulting therefrom (i.e. the second generation) "Domain Seed," whilst the seed resulting from the latter (i.e. the third generation) is known as "Domains Seed Fellahi." By this means it is hoped that a well-organised scheme, to which all the cultivators will have become accustomed, will be in good working order by the time that the pure seed types which are being bred on the experiment farms by Mendelian methods become available for distribution. It is anticipated that in the course of two or three years there will be a sufficient supply of such seed to replace the Domains seed at present employed in the distribution scheme.—IMPERIAL INSTITUTE BULLETIN

DIFFICULTIES IN FLOWER SHOW SCHEDULES.

REV. W. WILKS.

In 1911 I read a paper on "Difficulties in Flower Show Schedules," pointing out errors of frequent occurrence and their remedy. That this paper met a need and has been of some assistance to Horticultural Societies is, I think, proved by the fact that whereas formerly I used always to have a very heavy correspondence, during the months of July and August especially, relating to disputes on points of disagreement in schedules, I now receive such letters comparatively rarely. During the last two years I have collected a few further errors which have occurred and to which I think it worth while to call attention of other Societies.

1. *A dish of fruit—four varieties.*

An exhibitor staged two varieties of apples, one of tomatoes. and one of pears.

It was contended that four varieties of *one kind* of fruit were meant. but the schedule did not say so. Any four varieties of fruit, either of the same or of different kinds, were probably eligible.

I say "probably," for it is doubtful whether such an exhibit should not be disqualified, as it would consist of four dishes of fruit, and the schedule only asks for "a" dish, i.e. one dish containing four varieties.

1a. Another example of the same error was as follows:—

Fruit—collection of six varieties, white and black grapes allowed.

An exhibit of one bunch each of black and white grapes, one dish of figs, one of peaches, one of nectarine 'Pine Apple,' and one of nectarine 'Humboldt' was disputed on the ground that only one nectarine variety was eligible. As a matter of fact, four or even six varieties of nectarines would not have disqualified the exhibit. *Varieties* were asked for. The schedule should have asked for six kinds.

2. *Six stems of different varieties of Sweet Peas.*

The exhibitors were, one and all, staging one stem each of six varieties. To do so was quite within the wording of the schedule; or they might have staged six stems of each of an unlimited number of different varieties, without disqualification. What the Show Committee really intended to ask for was "six vases of different varieties of Sweet Peas, six stems in a vase."

3. "*The best collection of Hardy Flowers. No duplicate bunches or mixed bunches allowed.*"

The question arose—Were *Phlox decussata*, vars. 'Tapis blanc,' 'Etna,' and 'Sheriff Ivory,' to be considered as "duplicate bunches?"

No, certainly not. The schedule did not specify one variety of each kind, and different varieties of one kind cannot be considered duplicates of each other.

4. "*Nine hardy and half hardy annuals—dissimilar.*"

A dispute arose because one exhibit contained two annual chrysanthemums of different colours.

The term "dissimilar" is one which should have no place in horticulture, and it is not recognised by the Royal Horticultural Society. To put the case thus: Two men are walking along the road—one wears a green hat and the other a brown. Are they similar or dissimilar? As men they are similar, and different hats cannot make them otherwise; but as specimens of colour or varieties of clothing they are dissimilar.

The word is a very bad one to use, and will give endless trouble in a schedule. "Distinct kinds" or "distinct varieties" restrict to narrow limits the latitude for misunderstanding.

5. *A class for Sweet Peas "shown with own foliage."*

It was contended that the foliage meant was that actually belonging to the individual plant from which the flowers themselves were gathered.

This is not the interpretation for Flower Show purposes. So long as the foliage is that of the Sweet Pea (*Lathyrus odoratus*), and not of any other *Lathyrus* or *Pisum*, the intention of the schedule is met.—ROYAL HORTICULTURAL SOCIETY JOURNAL.

MARKET RATES FOR TROPICAL PRODUCTS.

(From Lewis & Peat's Latest Monthly Prices Current.

	QUALITY.	Quotations.
ALOES, Socotrine cwt.	Fair to fine	40/ a 50/
Zanzibar & Hepatic ,,	Common to good	40/ a 70/
ARROWROOT (Natal) lb.	Fair to fine	5d
BEES' WAX cwt.		
Zanzibar Yellow ,,	Slightly drossy to fair	£7 10/ a £7 15/
East Indian, bleached ,,	Fair to good	£8 10/a £8 12/6
,, unbleached ,,	Dark to good genuine	£6 5/a £7
,, Madagascar ,,	Dark to good palish	£7 15/ a £8 2/6
CAMPHOR, Japan lb.	Refined	1/7 a 1/8
China cwt.	Fair average quality	155/
CARDAMOMS, Tuticorin	Good to fine bold	5/9 a 6/
per lb.	Middling lean	4/8 a 5/4
Malabar, Tellicherry ,,	Good to fine bold	5/9 a 6/3
Calicut ,,	Brownish	3/9 a 5/3
Mangalore ,,	Med Brown to good bold	4/ a 6/4
Ceylon, Mysore ,,	Small fair to fine plump	4/ a 6/4
Malabar ,,	Fair to good	3/2 a 3/4
Seeds, E. I. & Ceylon ,,	Fair to good	4/ a 4/3
Ceylon "Long Wild" ,,	Shelly to good	2/3 a 3/6 nom.
CASTOR OIL, Calcutta ,,	Good 2nds	3½d
CHILLIES, Zanzibar cwt.	Dull to fine bright	50/ a 60/
Japan ,,	Fair bright small	60/ a 70/
CINCHONA BARK.—lb. Ceylon	Crown, Renewed	3⅜ d a 7 d
	Org. Stem	2d a 6d
	Red Org. Stem	1⅜ d a 4½d
	Renewed	3d a 5½d
	Root	1⅜d a 4d
CINNAMON, Ceylon 1sts.	Good to fine quill	1/3 a 1/9
per lb. 2nds.	,, ,,	1/2 a 1/7
3rds.	,, ,,	1/1 a 1/6
4ths.	,, ,,	1/ a 1/3
Chips.	Fair to fine bold	2d a 4d
CLOVES, Penang lb.	Dull to fine bright pkd.	1/ a 1/2
Amboyna ,,	Dull to fine	10d a 10½d
Zanzibar ,,	Fair and fine bright	5⅝d a 6¼d
Madagascar ,,	Fair	7d
Stems ,,	Fair	2d
COFFEE		
Ceylon Plantation cwt.	Medium to bold	Nominal
Liberian ,,	Fair to bold	63/ a 80/
COCOA, Ceylon Plant. ,,	Special Marks	81/ a 88/6
	Red to good	73/ a 80/6
Native Estate ,,	Ordinary to red	42/ a 68/
Java and Celebes ,,	Small to good red	30s a 93s
COLOMBO ROOT ,,	Middling to good	15/ a 22/6
CROTON SEEDS, sifted,,	Dull to fair	42/6 a 47/6
CUBEBS ,, ,,	Ord. stalky to good	130/ a 150/
GINGER, Bengal, rough ,,	Fair	19/
Calicut, Cut A ,,	Medium to fine bold	75/ a 85/
B & C ,,	Small and medium	35/ a 74/
Cochin, Rough ,,	Common to fine bold	22/6 a 27/
	Small and D's	20/
Japan ,,	Unsplit	20/
GUM AMMONIACUM ,,	Ord. Blocky to fair clean	40/s a 72s 6d
ANIMI, Zanzibar	Pale and amber, str. srts	£14 10/a £16 10/
,,	,, ,, little red	£11 a £12
,,	Bean and Pea size ditto	70/ a £11
,,	Fair to good red sorts	£8 10/ a £10 10/
,,	Med. and bold glassy sorts	£5 10/ a £7 5/
Madagascar ,,	Fair to good palish	£4 a £8
,, ,, red		£4 a £7
ARABIC, E. I. & Aden ,,	Ordinary to good pale	26/ a 32/6
Turkey sorts ,,	,, ,,	37/ a 57/6
Ghatti ,,	Sorts to fine pale	17/ a 27/
Kurrachee ,,	Reddish to good pale	22/6 a 32/6 nom.
Madras ,,	Dark to fine pale	20/ a 30/ nom
ASSAFŒTIDA ,,	Clean fr. to gd. almonds	£6 a £6 10/
	com. stony to good block	40s a £5
KINO lb.	Fair to fine bright	6d a 1/5
MYRRH, Aden sorts cwt.	Middling to good	57/6 a 67/6
Somali ,,	,, ,,	52s 6d a 55s
OLIBANUM, drop ,,	Good to fine white	45s a 50s
,,	Middling to fair	35s a 40s
pickings ,,	Low to good pale	15/ a 27/6
siftings ,,	Slightly foul to fine	18s a 25s
INDIA RUBBER lb.	Fine Para smoked sheets	2/4
Ceylon, Straits, ,,	Crepe ordinary to fine	2/2½
Malay Straits, etc. ,,	Fine Block	2/4½
	Scrap fair to fine	1/8 a 1/9
Assam ,,	Plantation	1/10
,,	Fair 11 to ord. red No. 1.	1/3 a 1/6
Rangoon ,,	,, ,, ,,	1/2 a 1/4

	QUALITY.	QUOTATIONS.
INDIA RUBBER lb.		
Borneo ,,	Common to good	9d a 1/3
Java ,,	Good to fine red	1/3 a 1/6
Penang ,,	Low white to prime red	9 d a 1/4
Mozambique ,,	Fair to fine red ball	1/9 a 2/1
,,	Sausage, fair to good	1/9 a 2
Nyassaland ,,	Fair to fine ball	1/9 a 2
Madagascar ,,	Fr. to fine pinky & white	1/4 a 1/6
,,	Majunga & blk coated	1/ a 1/2
,,	Niggers, low to good	6d a 1/6
New Guinea ,,	Ordinary to fine ball	1/4 a 1/7
INDIGO, E I. Bengal ,,	Shipping mid to gd. violet	3s 3d a 3s 8d
,,	Consuming mid. to gd.	2s 9d a 3s 2d
,,	Ordinary to middling	2s 4d a 2s 9d
,,	Mid. to good Kurpah	1s 11d a 2s 5d
,,	Low to ordinary	1s 6d a 1s 9d
,,	Mid. to fine Madras	1/11 a 2/9
MACE, Bombay & Penang	Pale reddish to fine	2/4 a 2/6
per lb.	Ordinary to fair	2/ a 2/2
Java	,, ,, good pale	2/ 1 a 2/4
Bombay	Wild	1/
NUTMEGS,— lb.		
Singapore & Penang ,,	64's to 57's	9½d a 10½d
	80's	7½d
	110's	6½d
NUTS, ARECA cwt.	Ordinary to fair fresh	17/6 a 20/
NUX VOMICA, Cochin	Ordinary to good	13/6 a 15
per cwt. Bengal	,, ,,	12/
Madras	,, ,,	12/ a 13/
OIL OF ANISEED lb.	Fair merchantable	5/2
CASSIA ,,	According to analysis	2/8 a 2/11
LEMONGRASS oz.	Good flavour & colour	2½d
NUTMEG ,,	Dingy to white	1½d a 1⅞d
CINNAMON ,,	Ordinary to fair sweet	4d a 1s 5d
CITRONELLE lb.	Bright & good flavour	1/6½
ORCHELLA WEED—cwt		
Ceylon ,,	Fair	10/6
Madagascar ,,	Fair	10/6
Zanzibar ,,	Fair	10/6
PEPPER—(Black) lb.	Fair	5d
Alleppy & Tellicherry	Fair to fine bold heavy	5d a 5⅜d
Ceylon ,, ,,	Fair	4⅝d
Singapore ...	Dull to fine	5d a 5½d
Acheen & W. C. Penang	Fair to fine	8½d a 8¾d
(White) Singapore ,,	Fair	8½d
Siam ,,	Fair	7⅞d
Penang ,,	Fair	9d
Muntok ,,	Ordinary to good	2/ a 4/
RHUBARB, Shenzi ,,	Ordinary to good	1/10 a 3/6
Canton ,,	Fair to fine flat	11d a 1/1
High Dried,,	Dark to fair round	9 d a 10d
SAGO, PEARL, large--cwt	Fair to fine	18/
medium ...	,, ,,	16/
small ...	,, ,,	13/ a 14/
Flour ...	Good pinky to white	10/ a 11/
SEEDLAC cwt.	Ordinary to gd. soluble	65/ a 75/
SENNA, Tinnevelly lb.	Good to fine bold green	5d a 8½d
	Fair greenish	3d a 4½d
	Common specky & small	1½ d a 2½d
SHELLS, M. o' PEARL—		
Egyptian cwt.	Small to bold	72/6 a £6
Bombay ,,	,, ,,	85/ a £6 10/
Mergui ,,	Chicken to bold	£8 12/6 a £145
Manilla ,,	Fair to good	£7 17/6 a 13 10
Banda ,,	Sorts	50/ nom.
Green Snail ,,	Small to large	70/ a 85/
Japan Ear ,,	Trimmed selected small to bold	47/ a £5 15
TAMARINDS, Calcutta...	Mid to fine bl'k not stony	14/ a 15/
per cwt. Madras	Inferior to good	6/ a 10
TORTOISESHELL—		
Zanzibar & Bombay lb.	Small to bold	12/ a 26/
	Pickings	6/6 a 19/
TURMERIC, Bengal cwt.	Fair	12/ a 13/
Madras ,,	Finger fair to fine bold	14/ a 16/
Do. ,,	Bulbs ,, ,, [bright	12/ a 13/
Cochin ,,	Finger fair	13/ nom.
	Bulbs ,,	11/6 a 12/
VANILLOES— lb.		
Mauritius ... } 1sts.	Gd. crystallized 3½a 8½ in.	9/6 a 15/
Madagascar ... } 2nds.	Foxy & reddish 3½a ,,	9/ a 12/
Seychelles ... } 3rds.	Lean and inferior	9/ a 9/6
VERMILLION ... lbs.	Fine, pure, bright	2/7
WAX, Japan, squares cwt.	Good white hard	47/6